GENERATION, TRANSMISSION AND APPLICATION OF THE POWER SERVICES

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Power

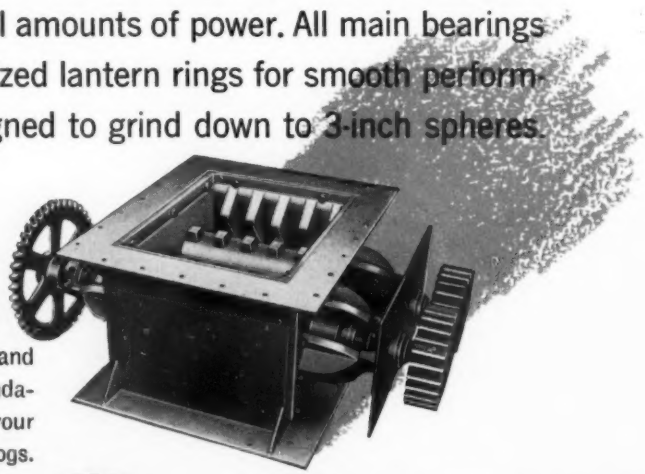
February
1953·50¢

A McGRAW-HILL PUBLICATION

Pfizer slashes downtime with planned electrical maintenance · 107

A better way to make big ones into little ones

We've learned a lot about making clinker grinders in the past quarter century, and we believe this new model is the best around. Users report that it is not only extremely rugged, but also saves substantial amounts of power. All main bearings are protected by pressurized lantern rings for smooth performance and long life. Designed to grind down to 3-inch spheres.



This new A-S-H Clinker Grinder is just another example of how our engineers "git there fustest with the mostest" in ash and dust handling equipment. Their recommendations will be of vital assistance to you on your next project. Write for our latest catalogs.

THE ALLEN-SHERMAN-HOFF CO.
Dept. A—259 E. Lancaster Ave., Wynnewood, Pa.
Offices and Representatives in Principal Cities

HYDROJET *(hydraulic)* **HYDROVAC** *(pneumatic)*

materials handling systems

Otter Tail Power Company handles lignite efficiently on Link-Belt conveyor system

Read how LINK-BELT's unequalled experience plus quality equipment pays off in low fuel handling costs

WHEN OTTER TAIL POWER CO. planned their Ortonville (Minn.) station, economics dictated lignite be used as fuel. Recognizing the handling difficulties, they and consultant J. F. Pritchard and Co. agreed Link-Belt's broad fuel handling experience offered the best assurance of an efficient system.

And they were right: The Link-Belt-designed system moves up to 240 tons of lignite per hour. Smooth handling minimizes the dusting that is a problem because of the ease with which lignite disintegrates. Clinging or freezing to conveyor belts—and consequent belt misalignment—is solved by using snub and bend pulleys of open slat construction.

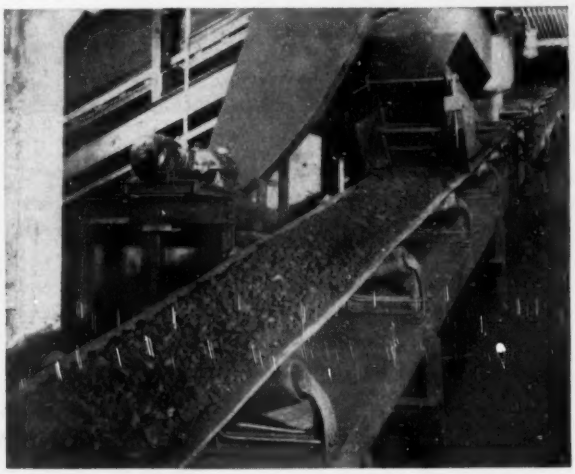
You will find it pays to rely on Link-Belt for every detail of your coal handling system—from planning to erection, if desired. Link-Belt builds a complete, quality line for every step in handling coal—from railroad car or ship to bunker. For full information, call the Link-Belt office near you. An experienced engineer will be glad to work with you and your consultants—help you plan for highest efficiency.

LINK-BELT

COAL HANDLING EQUIPMENT

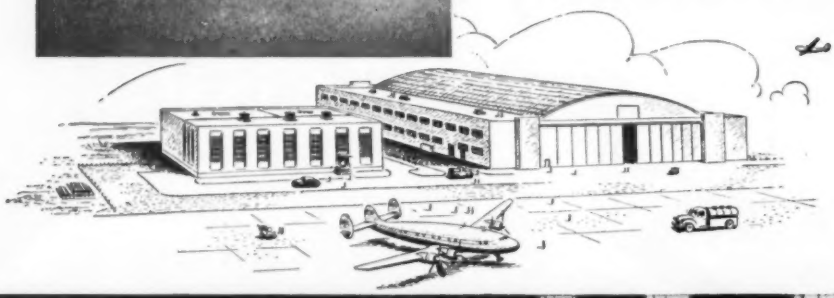
LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales Offices in Principal Cities. 13,047

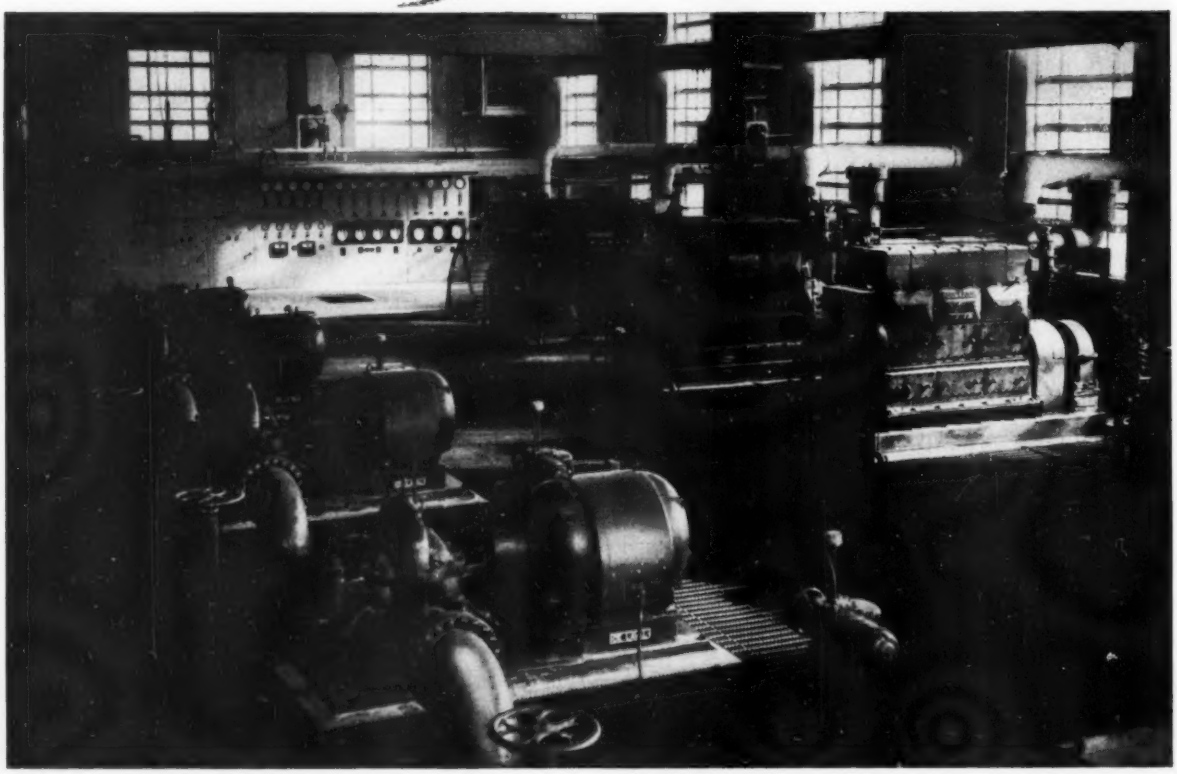
Double track dump hoppers and double reciprocating plate feeder serve inclined belt conveyor, extending to crusher. Additional Link-Belt conveyors carry material direct to steam plant bunker or to storage yard.



Note full load of lignite carried by Link-Belt inclined belt conveyor from hoppers to crusher. Inclined steel apron conveyor from yard coal reclaim hopper to belt conveyor is seen at top left.

DE LAVAL FIRE PUMPS *on the job at Idlewild*





Ten De Laval centrifugal pumps, with a total capacity of 34,000 gpm, play a vital role in the deluge fire-fighting system of the New York International Airport at Idlewild, Long Island.

The installation is composed of two 2,500 gpm and three 4,000 gpm motor-driven pumps as well as two 2,500 gpm and three 4,000 gpm diesel-driven units, which are used for standby service. When the normal operating pressure drops from 165 psi to 140 psi or less, the electric pumps go to work automatically. The diesels are brought into service as necessary.

Efficient De Laval centrifugal pumps are serving water works and fire-fighting stations all over America. These pumps are available in capacities ranging from less than one million gallons per day to more than 100 million gallons per day.

DE LAVAL *Centrifugal Pumps*

DE LAVAL STEAM TURBINE COMPANY
815 Nottingham Way, Trenton 2, New Jersey

DL 177

Power

FEBRUARY 1953 • VOLUME 97 NUMBER 2

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POWER articles are indexed in both the *Industrial Arts Index* and the *Engineering Index*. POWER publishes its own annual index, which is available for 50¢ from the editorial offices.

ELECTRICAL MAINTENANCE is a fine art at Charles Pfizer & Co, world's largest producers of antibiotics. It has to be, because shutdowns of delicate processes are costly. As our out-of-plant report (pp 107-113) tells, Pfizer engineers start by designing to eliminate maintenance as far as possible. Then, by careful planning, smart organization and ingenious methods, they speed necessary maintenance to cut downtime.

In the cover photo, McGraw-Hill photographer Chris Grube catches one of the many Pfizer maintenance ideas. Blueprints, combining wiring diagrams and schematics, are out where they're needed, not back in the files. So when an electrician reaches the trouble spot he's got everything he needs. It's just one of the little things that add up to an efficient maintenance program.

Next month . . .

■ Are you making the most of what today's hard-surfacing methods offer? Our 16-pg practical manual will tell you what they can do, show you step-by-step how to hard-surface by electric arc, torch, spray and other methods, pass along sound tips on putting them to work saving maintenance dollars in your own plant.

■ In paper and textile mills, new ways of trapping Btu's cut fuel cost, as an upcoming article shows. Can such "economizers" help you?

■ Peacetime applications of nuclear research continue to grow. Right now radioactive materials are helping to find answers to industry's lubrication problems. A March story tells how.

■ Remember Ed Kates' comprehensive series on diesel instruments and controls? Starting next month, a new one, on governors, takes you from fundamentals right through specific types to practical applications.

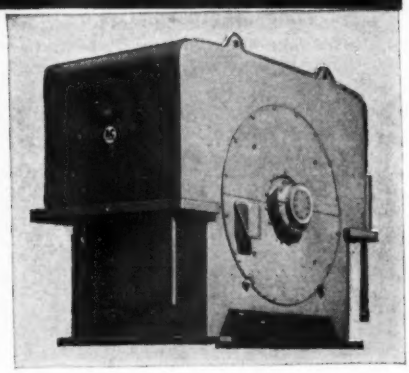
. . . and future months

■ To see how pumped storage improves power-system operation, watch for our story on Switzerland's Etzel development. In its 120,000-hp hydro station, two 35,000-gpm 5-stage pumps work against the high head of 1611 ft.

NO HOUSING PROBLEM

. . . with this Outdoor Motor

Weather-Protected MOTORS



BEST WAY to solve a housing problem is to eliminate the need for housing! That's exactly what the Allis-Chalmers weather-protected motor does. It eliminates the need for a costly building . . . costly in added capital investment, costly in upkeep, and costly in extended construction time.

Proved by Special Tests

We know this weather-protected design can give you these savings . . . plus dependable performance . . . because we've tested it under extreme conditions.

Take the 900-hp, 435-rpm, 4160-volt motor shown above. While running at normal speed and voltage, it was deluged with water at rates up to 40 inches per hour — driven by winds up to 75 miles per hour. This was done repeatedly from all angles. But on inspection, no moisture was detected on the windings of this weather-protected motor.

And other tests checked its effectiveness in keeping out wind-driven fine sand.

Bulletin Describes Features

The construction features that provide this economical, super-splashproof performance are available in ratings for all major auxiliary drives. For more information, ask your nearby A-C representative for Bulletin 05R7874, or write to Allis-Chalmers, Milwaukee 1, Wisconsin. A-3907

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

Power

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...with Power readers...

CUTTING VIBRATION . . .

I wish to comment on Francis P Witmer's article, "How to Cut Vibration in Big Turbine-Generator Foundations," which appeared in November.

For several years I have had the opportunity to design more than a dozen large turbine-foundations up to 150,000-kw capacity. The detailed design of a 100,000-kw unit was described in "Foundation for a Large Turbogenerator," a paper by Paul Rogers, Nov 1951 issue of *Journal of the American Concrete Institute.*

It has been customary to provide a considerable mass to load ratio for such turbine foundations, and experience indicates that supports designed on such basis are relatively free from disturbing vibrations. Lately, however, design engineers have become more conscious of the possibility of resonance between the vibration of the unit and the natural frequency of vibration of the support.

Some recommendations from turbine manufacturers call for the avoidance of such support deflections that would produce equal frequency of vibration with the unit. The formula for such deflection is usually based on the spring factor of a single degree of freedom system.

The supporting girders, however, are

(*Continued on page* 208)

...lines and bylines

McClain, Townsend, Krauss and plans for cutting maintenance

GOOD MAINTENANCE STARTS HERE—in the planning of these three Pfizer engineering executives. Director of Engrg D C McClain came to Pfizer 36 years ago, after powerhouse and high-tension work with Westinghouse, Church, Kerr & Co. He's a Univ of Illinois man.

W R Townsend, chief engineer, is a Rensselaer graduate, a member of ASME, AIEE. He gained early experience with American Sugar Refining Co and several consulting firms before joining Pfizer 23 years ago. Directly responsible for operations described on pp 107-113 is William Krauss, electrical engineer. A Pratt Institute graduate, he's designed and supervised several large Pfizer power and light installations in the 23 years he's been with this growing firm.

V J Calise

FAMILY HOBBIES are Vince Calise's greatest enthusiasm outside his work as Director of Research and Product Development for Graver Water Conditioning Co. Vince, his wife, daughter, and son work in the arts — music, painting, sculpture — as a group. Besides having a lot of fun, the boy shows some talent for sculpture and the girl marked ability at the easel. Vince is modest about his own talents — he just says he finds painting, particularly the abstract variety, extremely relaxing.

Water conditioning has been Calise's prime professional interest since student days at Brooklyn Poly and City College, N. Y. He was with Permutit and Liquid Conditioning Corp before joining Graver.

A L Aicher

THE ARTS rate high with our authors this month — Alfred Aicher enjoys nothing so much as listening to good music, collects classical records. We're deep in the record-collecting game ourselves but we've never tried Al's other hobby—wood carving.

He studied mechanical engineering at Drexel Institute and started to put it to work at American Engineering Co. Then, in 1919, he moved over to the engineering department of the Yarnall-Waring Co. Later, Al went into field service work and for the past 12 years has been in field sales. From this daily contact with equipment users, Al has picked up a good many ideas about what plant engineers want to know, passes some along in the article beginning on p 84.

14 YEARS

of operating experience with STEAM

OVER 2000 PSI

An important element in successful high-pressure operation is the B&W Cyclone Steam Separator, developed by B&W Research. This simple, highly efficient device is typical of the manner in which B&W's progressive research pushes the science of steam generation to ever higher levels of economy.

For those seeking the high steam-cycle efficiencies obtainable with steam pressures over 2000 psi, B&W offers unparalleled design and operating experience . . . drawing upon a background extending over the last 14 years with units to-serve over 10,000,000 kilowatts of generating capacity.

The outstanding performance records of the 14 B&W installations already operating in this range have given strong impetus to the present trend toward use of pressures over 2000 psi . . . have resulted in orders for more than 60 additional B&W units with design pressures up to 2700 psi.

B&W's many years of experience in designing and building boilers for economical, high-pressure steam generation, as exemplified in the list on the opposite page, are at your service.

G-585T

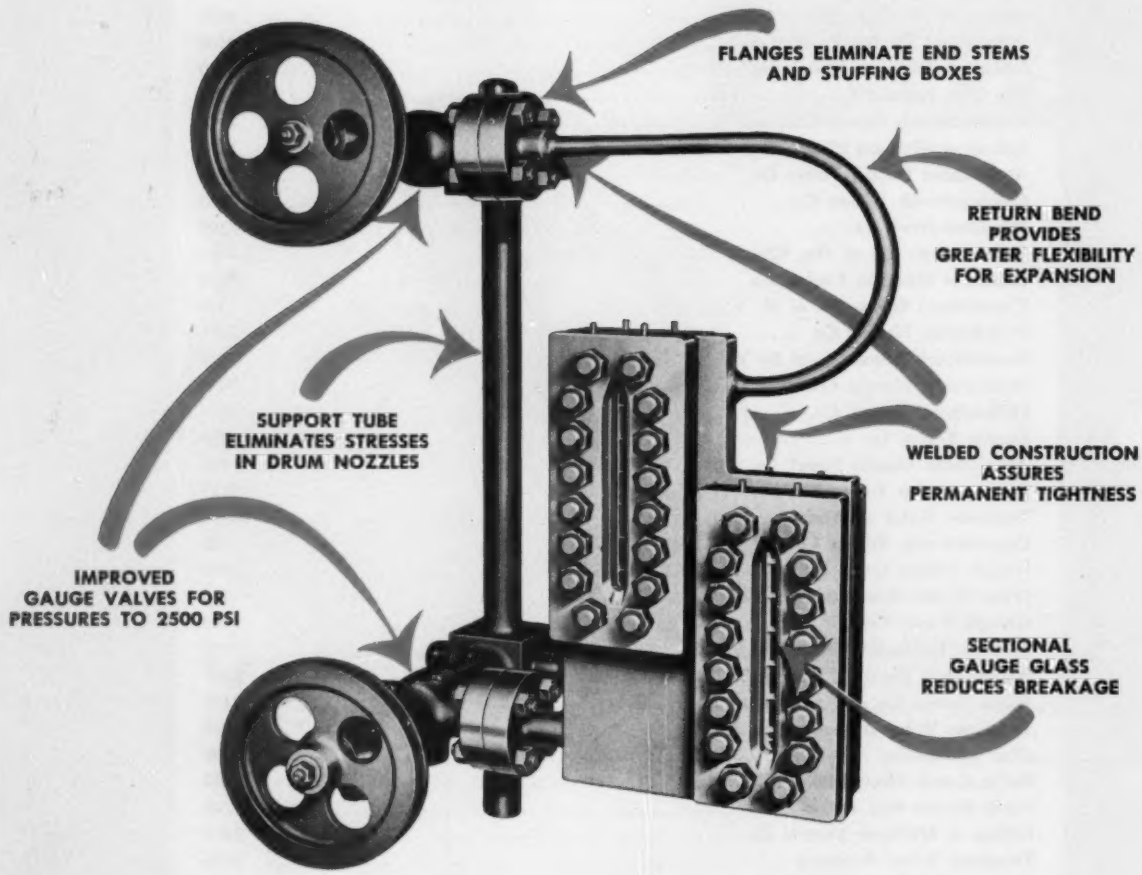
B&W BOILERS WITH DESIGN PRESSURES OVER 2000 PSI

Owner	Boiler Design Pressure
Diamond Alkali Co.	2200
Indiana & Michigan Electric Co.	2650
Appalachian Electric Power Co.	2300
Indiana & Michigan Electric Co.	2300
The Ohio Power Co.	2300
Commonwealth Edison Co.	2125
Indiana & Michigan Electric Co.	2300
Appalachian Electric Power Co.	2300
Commonwealth Edison Co.	2125
The Ohio Power Co.	2300
Public Service Co. of No. Illinois	2050
Indiana & Michigan Electric Co.	2300
Consolidated Edison Co. of N. Y.	2050
Philadelphia Electric Co.	2075
Consolidated Edison Co. of N. Y.	2050
Pennsylvania Electric Co.	2080
Philadelphia Electric Co.	2075
Detroit Edison Co.	2050
Appalachian Electric Power Co.	2400
Commonwealth Edison Co.	2125
Tennessee Valley Authority	2050
Commonwealth Edison Co.	2125
Detroit Edison Co.	2050
Jersey Central Power & Light Co.	2225
Georgia Power Co.	2100
Southern California Edison Co.	2050
Narragansett Electric Lighting Co.	2350
Public Service Co. of No. Illinois	2125
Tennessee Valley Authority	2050
Ohio Edison Co.	2300
Pacific Gas & Electric	2050
Public Service Elec. & Gas	2700
Indiana & Michigan Electric Co.	2400
Tennessee Valley Authority	2050
Tennessee Valley Authority	2050
Tennessee Valley Authority	2050
The Ohio Power Co.	2400
The Ohio Power Co.	2400
Ohio Edison Co.	2300
Consolidated Gas Electric Light & Power Co.	2075
Ohio Valley Electric Corp.	2400

TOTAL GENERATING CAPACITY SERVED: OVER 10,000,000 KILOWATTS

New DIAMOND Flange Connected WATER GAUGES

More Suitable to High Pressure Operation


FLANGES ELIMINATE END STEMS AND STUFFING BOXES
RETURN BEND PROVIDES GREATER FLEXIBILITY FOR EXPANSION
SUPPORT TUBE ELIMINATES STRESSES IN DRUM NOZZLES
WELDED CONSTRUCTION ASSURES PERMANENT TIGHTNESS
IMPROVED GAUGE VALVES FOR PRESSURES TO 2500 PSI
SECTIONAL GAUGE GLASS REDUCES BREAKAGE

In addition to the advantages shown above, this gauge provides maximum level visibility with minimum drum nozzle spacing. Greater reading accuracy is another important feature. The bend (which is uninsulated) provides sufficient condensing area to assure active circulation of hot condensate through the gauge. This maintains the gauge at higher temperature so there is less difference between boiler water and gauge water density. That and the shorter gauge assure greater accuracy.

Write for new Bulletin No. 1051 describing Diamond Water Gauges and Water Columns.

DIAMOND POWER SPECIALTY CORPORATION

LANCASTER, OHIO

Diamond Specialty Limited—Windsor, Ontario

4860

"Clean Enough to Suit Aunt Lena"

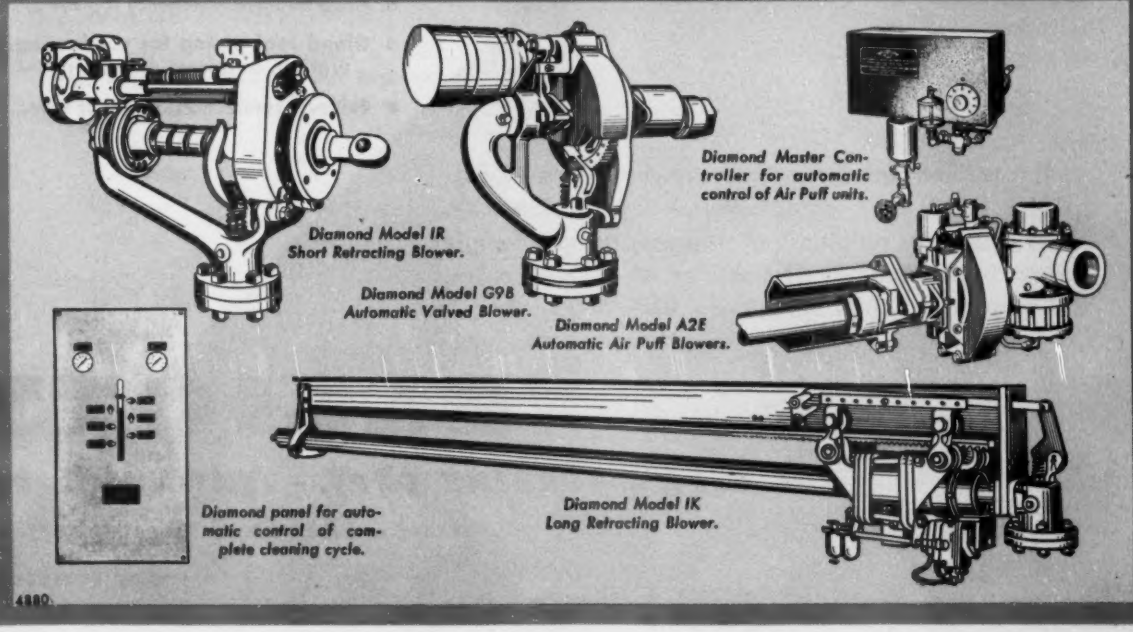
That's DIAMOND'S Boiler Cleaning Objective

According to "Kaffeeklatsch" gossip in Pittsburgh's German quarter (circa 1900), Aunt Lena scrubbed all the floors every day, washed the porch, steps and sidewalk and swept the street to the middle. Certainly she was an uncompromising and relentless enemy of dirt. Her house was so clean it excited the envy of the women, and frightened little children and husbands . . . no mean feat in the exacting colony of the "Scrubbin' Dutch".

Aunt Lena became a legend and a standard of perfection. "Clean enough to suit Aunt Lena" became the hole in one, the one-round knockout, the no-hit pitching in those dirt-annihilation circles.

Probably it wouldn't be possible to keep a boiler clean enough to "suit Aunt Lena", but Diamond Blowers can and do keep them clean enough to meet the most exacting requirements of engineers throughout the country. Diamond gives you better boiler cleaning—at lower over-all cost.

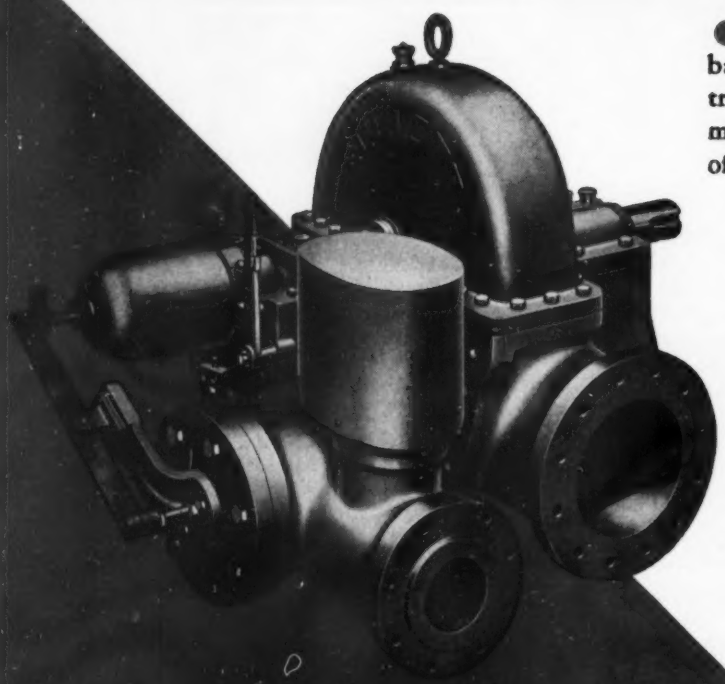
DIAMOND POWER SPECIALTY CORP.
LANCASTER, OHIO
Diamond Specialty Limited — Windsor, Ontario


Diamond Model IR Short Retracting Blower.
Diamond Model G9B Automatic Valved Blower.
Diamond Master Controller for automatic control of Air Puff units.
Diamond Model A2E Automatic Air Puff Blowers.
Diamond panel for automatic control of complete cleaning cycle.
Diamond Model IK Long Retracting Blower.
4880.

Both strong in

YR Turbines

ELLI



● YR Turbines are built on a production basis, but engineered to allow an extremely wide range of modifications to meet specific conditions. Here are some of them:

- **Five frame sizes —**
- **Eight different turbine types —**
- **Your choice of several governors each independent of the standard overspeed governor —**
- **Six elective control devices, including:**

1. Two hand valves controlling nozzling
2. Hand-operated speed changer
3. Remote control speed changer, air or electric
4. High exhaust pressure trip
5. Remote control electrical trip
6. Hand throttled emergency trip valve.

- **Gland seal piping for condensing operation, or operation with gas —**
- **Exhaust connection on either side.**

ELLIOTT

STEAM TURBINE DEPT. • JEANNETTE, PA.

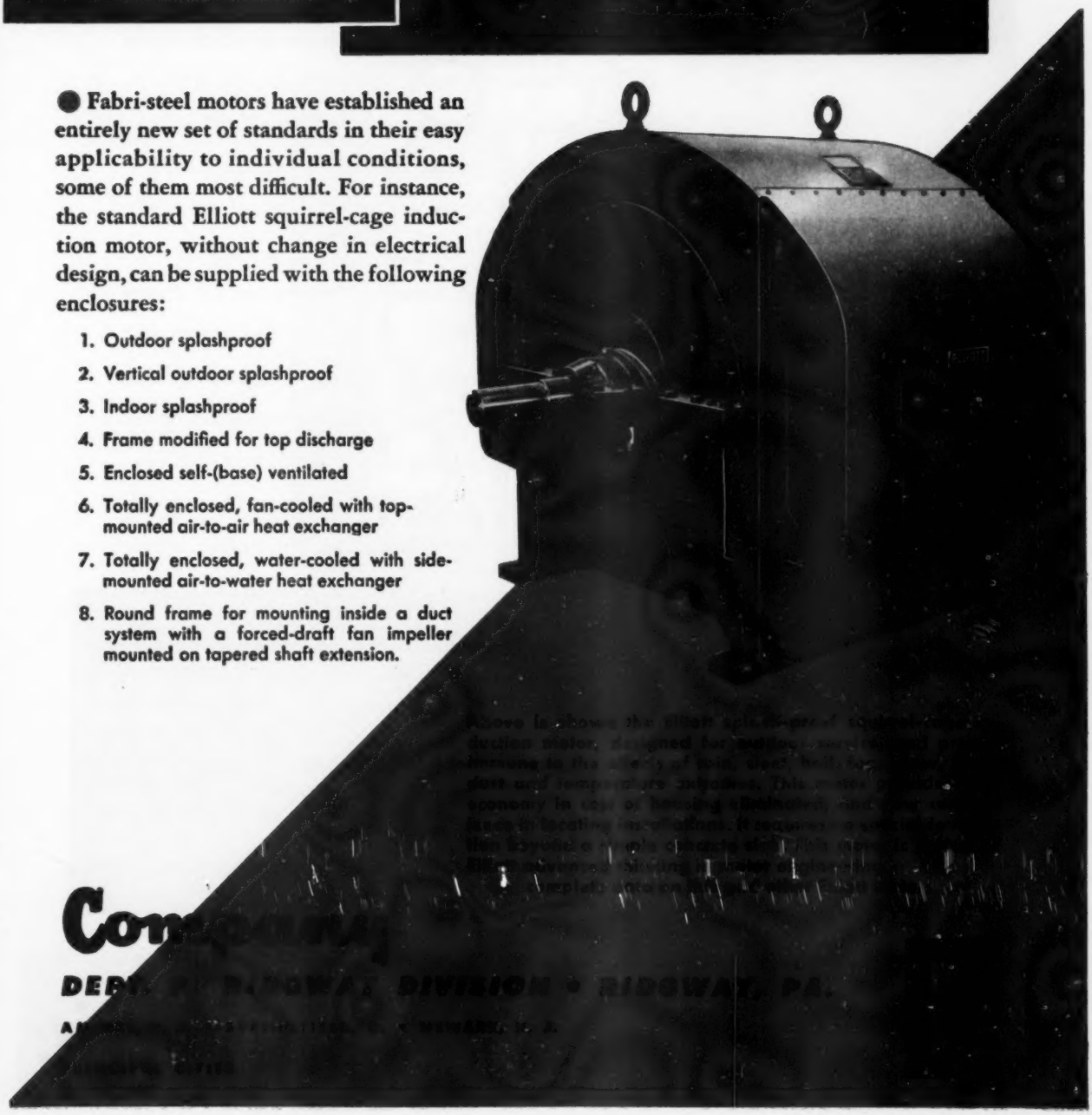
Plants at JEANNETTE, PA. • MEADVILLE, PA.

adaptability!

OTT Motors

● **Fabri-steel motors have established an entirely new set of standards in their easy applicability to individual conditions, some of them most difficult. For instance, the standard Elliott squirrel-cage induction motor, without change in electrical design, can be supplied with the following enclosures:**

1. Outdoor splashproof
2. Vertical outdoor splashproof
3. Indoor splashproof
4. Frame modified for top discharge
5. Enclosed self-(base) ventilated
6. Totally enclosed, fan-cooled with top-mounted air-to-air heat exchanger
7. Totally enclosed, water-cooled with side-mounted air-to-water heat exchanger
8. Round frame for mounting inside a duct system with a forced-draft fan impeller mounted on tapered shaft extension.



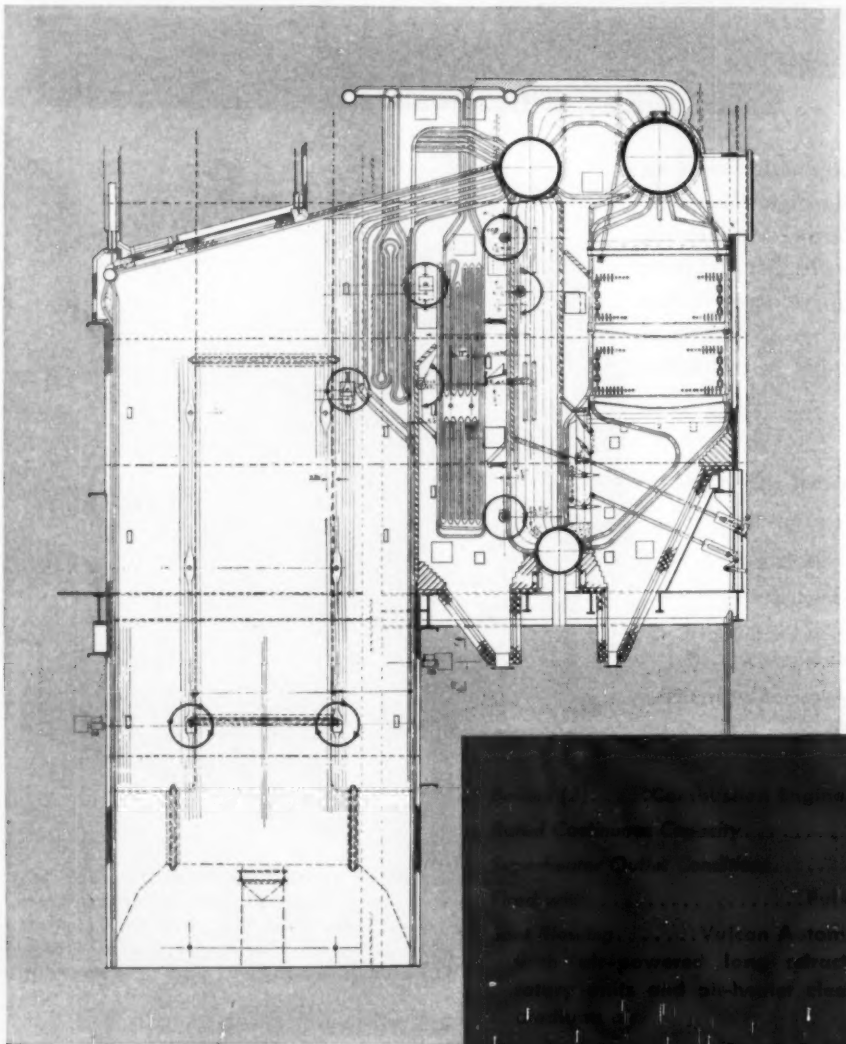
Co

DE

A

VULCAN *for the 74th*

BOARD OF



VULCAN Automatic

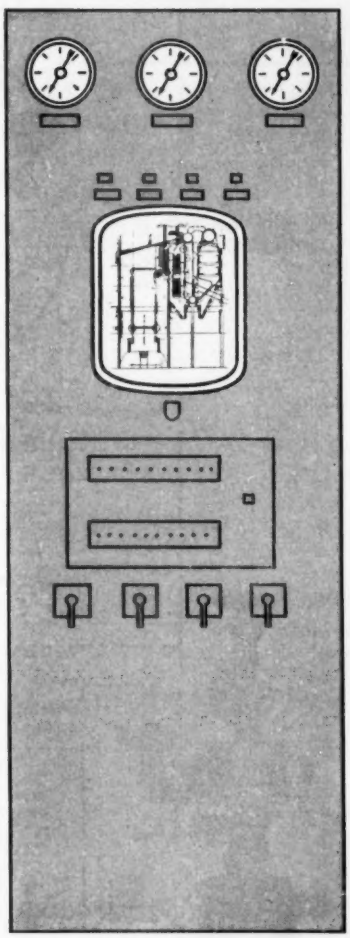
STREET STATION

it's AUTOMATIC-SEQUENTIAL

High boiler availability will be at a premium at 74th Street Station where power is generated for New York's transportation system.

The important job of boiler cleaning was given to Vulcan. Soot blowers will be ready for service at the flick of an operator's wrist. Their operating cost will be low, and the little maintenance needed can be handled quickly—usually without removing the blower from its mounting.

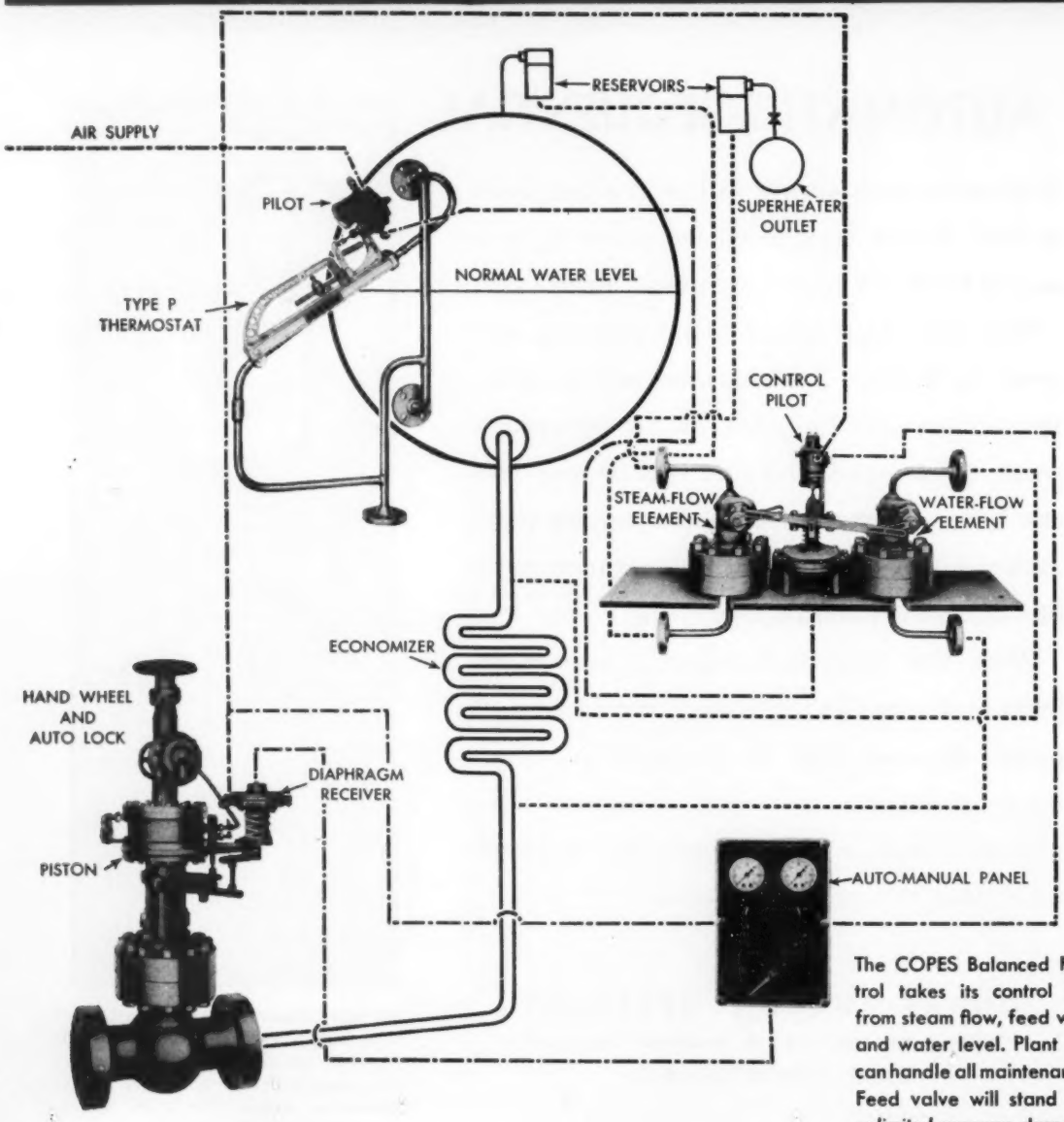
With the Vulcan Automatic-Sequential System, the entire job is done from a central panel. Blowers may be operated in automatic or selective sequence, or individually, and each blower reports back to the panel —no need to patrol the boiler.



All soot blower instruments and controls may be placed on a special open or cubicle type panel, or may be grouped as desired on the boiler operating panel. The 74th Street panel is the cubicle type.

COPES-VULCAN DIVISION
CONTINENTAL FOUNDRY & MACHINE COMPANY
ERIE, PENNSYLVANIA

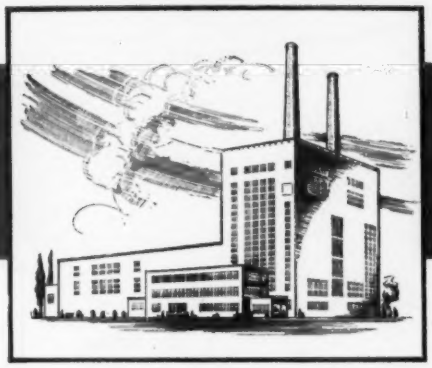
CONSUMERS POWER



The COPES Balanced Flow Control takes its control influences from steam flow, feed water flow and water level. Plant personnel can handle all maintenance easily. Feed valve will stand up under *unlimited* pressure drops.

COPES BOILER FEED

COMPANY



orders its 17th COPES Multi-Element Regulator

Add Justin R. Whiting Plant to the growing list of modern stations to have their boiler feeding under COPES Multi-Element Control.

Units 1 and 2, now being erected, will have 2-element COPES Flow-matics applied to hydraulic couplings of the boiler feed pumps.

Unit 3, recently ordered, will have 3-influence COPES Balanced Flow Control as shown schematically.

Whether you prefer one, two or three control influences for feeding your boilers, COPES can give you close level control and correct feed —without depending on any other instruments.

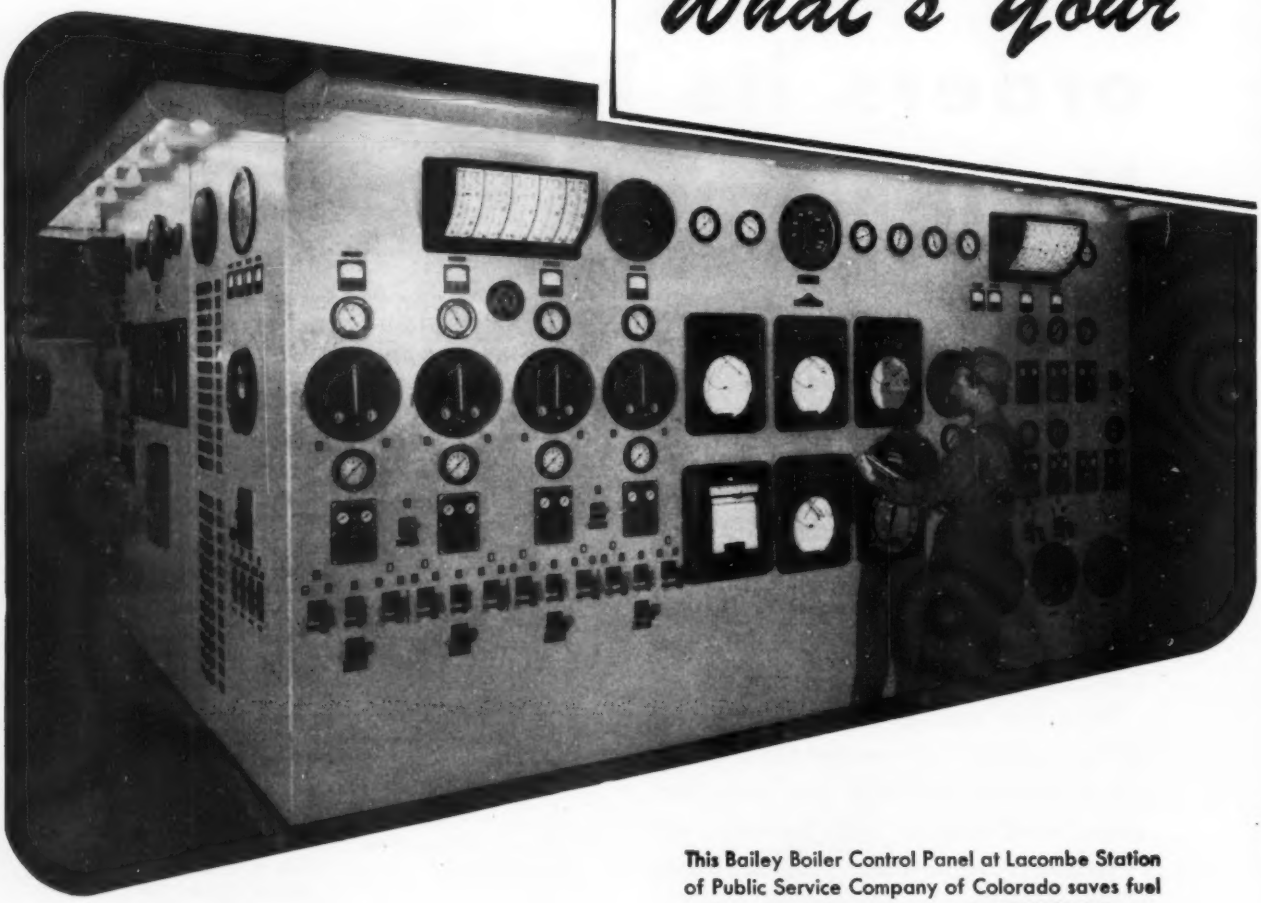
COPES MULTI-ELEMENT REGULATORS AT CONSUMERS POWER COMPANY

PLANT AND LOCATION	BOILER DATA No.	Make	WSP Psi	Max. Cap. Lb. per Hour
B. C. Cobb Plant Muskegon, Michigan...	3	C-E	875	600,000
Elm Street Plant Battle Creek, Michigan.	1	B & W	850	360,000
Bryce E. Morrow Plant Comstock, Michigan....	2	F W	875	400,000
	1	F W	875	550,000
	1	F W	875	600,000
John C. Weadock Plant Bay City, Michigan....	2	F W	875	400,000
	2	F W	875	550,000
	2	F W	875	600,000
Justin R. Whiting Plant Erie, Michigan.....	2	B & W	1600	690,000
	1	B & W	1600	860,000

COPES-VULCAN DIVISION
CONTINENTAL FOUNDRY & MACHINE COMPANY
ERIE, PENNSYLVANIA

WATER REGULATORS

What's Your



This Bailey Boiler Control Panel at Lacombe Station of Public Service Company of Colorado saves fuel and insures safe operation of a 350,000 lb per hr 850 psi, 900 F boiler fired by pulverized Colorado Lignite Coal and/or natural gas.

Controls for Steam Plants

COMBUSTION • PRESSURE
FEED WATER • LIQUID LEVEL
TEMPERATURE • FEED PUMPS

Control-Dollar Efficiency ?

Control-dollars frequently bring annual investment returns of 100% or more. When you buy adequate, well-applied steam plant controls, you increase your dollars' ability to work usefully for you.

That's where Bailey can help: Bailey Controls can give you a better control-dollar efficiency. Here's why:

1. Complete Range of Equipment — fully co-ordinated. You need never worry that a Bailey Engineer's recommendation is slanted in favor of a particular type of equipment, just because he has a limited line to sell — or that Bailey will pass the buck for efficient control; we offer *complete* boiler control systems.

2. Engineering Service — backed by experience. No other manufacturer of instruments and controls can offer as broad an experience, based on successful installations involving all types of combustion, flow measurement, and automatic control.

3. Direct Sales-Service — conveniently located near you. Bailey Meter Company's sales-service engineers are located in more industrial centers than those of any other manufacturer of boiler control systems; you get prompt, experienced service with a minimum of travel time and expense.

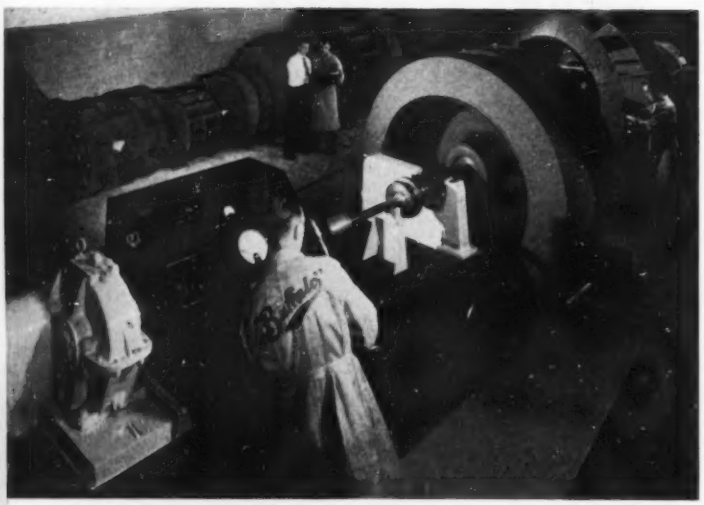
For better control-dollar efficiency—for more power per fuel dollar, less outage, and safer working conditions, you owe it to yourself to investigate Bailey Controls. Ask a Bailey Engineer to arrange a visit to a nearby Bailey installation. We're proud to stand on our record: "More power to you!"

A-112-2

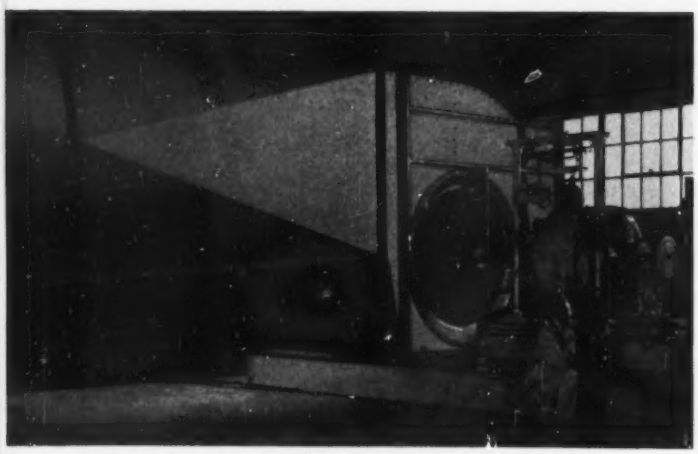
BAILEY METER COMPANY

1036 IVANHOE ROAD • CLEVELAND 10, OHIO
BAILEY METER COMPANY LIMITED • MONTREAL, CANADA

Why it costs more to build



Dynamic balance of "Buffalo" fan wheels guarantees smooth, quiet operation.



Accurate testing assures rated performance of "Buffalo" Fans.

As many readers of this advertisement know, "Buffalo" was the first manufacturer of air moving equipment to treat air engineering as a serious scientific subject, worthy of continuous study. With the publication, in 1914, of "Fan Engineering", now in its Fifth Edition, Buffalo Forge Company paved the way for the tremendous expansion in all forms of air handling, conditioning and cleaning, which we now accept as commonplace.

We have never deviated, for one year, from the ideals which led to "Fan Engineering" in 1914. We are still interested basically in the "Q" Factor.* This means the building of the best possible product.

This policy has cost us some business in the past, and no doubt will in the future. It has, however, earned us a reputation for fine performance over long periods of years, and has enabled our company to sell many of the finest and most outstanding installations in industry and commerce.

When you buy "Buffalo" Fans, Air Cleaning or Conditioning Equipment, you can be sure that you are getting the best that seventy-five years of experience can produce.

Engineering Sales Representatives in all principal cities are anxious to work with you.

**The "Q" Factor — The built-in Quality which provides trouble-free satisfaction and long life.*

DIAMOND JUBILEE 75TH ANNIVERSARY

FORCED DRAFT EXHAUSTING AIR TEMPERING HEATING

"Buffalo" FANS

"Buffalo" vacuum pit for test-spinning rotors. Extremely low vacuum in pit enables rotors to be spun at high speeds to ultimate destruction.

BUFFALO "Buffalo" FORGE COMPANY

488 BROADWAY BUFFALO, NEW YORK

PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

INDUCED DRAFT AIR CLEANING COOLING VENTILATING PRESSURE BLOWING

When you have a water conditioning problem—the first thing to do is call

cochrane

Whether your requirements are large or small, call a Cochrane Water Engineer. Supported by his recommendation, you'll be sure you're right.

. . . water conditioning is a problem for specialists. The Cochrane people specialize in water engineering and water conditioning equipment. And since Cochrane manufactures all types of water treating equipment their recommendations are unbiased. Cochrane engineers will show you how to obtain most economically the quality of water you want. Call Cochrane first when you have a water conditioning problem.

THERE'S A COCHRANE SOFTENING PROCESS TO GIVE YOU THE WATER YOU WANT

When you have a water softening problem—Cochrane Water Engineers can give you the right answer. Through many years of experience in all types of water treatment—including ion exchange—Cochrane offers five distinct processes, each with specific advantages for a particular job:

Hot Zeolite Process
Sodium Zeolite
Hydrogen Zeolite
Dealkalization
Demineralization

A Cochrane Water Engineer will be glad to explain the differences in these processes. He'll show you how the one process best suited to your requirements will provide water of the quality you want, cheaply and abundantly—from any raw water.

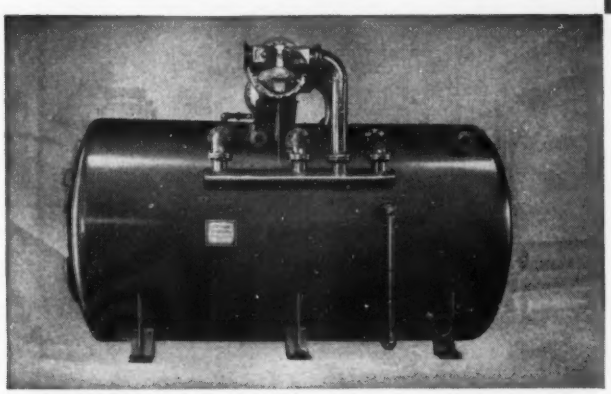
COMPLETE DEAERATION OF BOILER FEEDWATER

Cochrane provides all types of Deaerators to meet any requirements:

Tray-Type Deaerators
Atomizing Deaerators
Deaerating Hot Water Generators
Cold Water Deaerators

One of these units can be applied to your particular boiler feedwater requirements and built of materials suited to your service. A Cochrane Water Engineer will bring you the benefit of Cochrane's long experience in conditioning boiler feedwater.

Cochrane Zeolite Softener installed with a HYDROMATIC Single Control Valve.



Cochrane Tray-Type Deaerator for Central Station installation in the Southwest.

Cochrane equipment covers the full range of water conditioning:

HOT PROCESS SOFTENERS
HOT AND COLD ZEOLITE SOFTENERS
DEAERATORS & OPEN HEATERS DEMINERALIZERS
DEALKALIZERS DEGASIFIERS
REACTORS & CLARIFIERS
CONTINUOUS BLOWOFF SYSTEMS
STEAM SPECIALTIES CONDENSATE RETURN SYSTEMS

To give you prompt consultation and service, Cochrane Water Engineers are strategically located in 29 cities throughout the United States. Write today for the address of our office nearest you.

COCHRANE CORPORATION — WATER ENGINEERS FOR 90 YEARS — 1863 - 1953

cochrane

corp. 3106 N. 17TH STREET, PHILADELPHIA 32, PA.

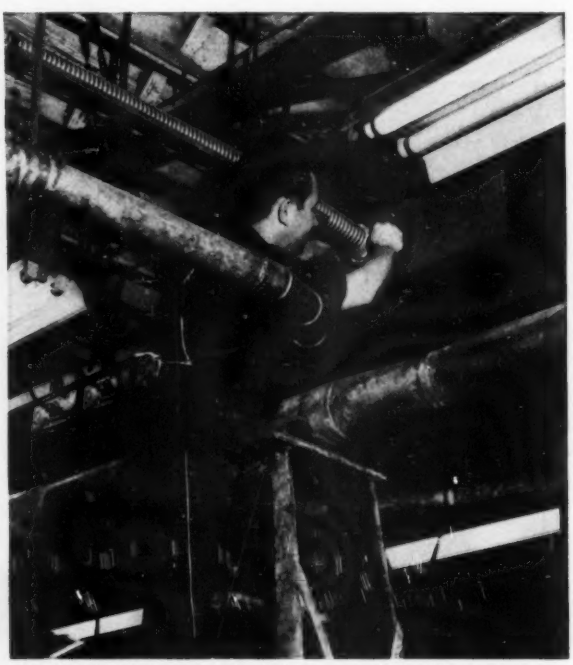
In Canada: Canadian General Electric Co., Ltd., Toronto
In Mexico: Babcock & Wilcox de Mexico, S.A., Mexico City
In Europe: Recuperation Thermique & Epuration, Paris

1878 75 1953
YEARS OF ELECTRICAL PROGRESS
MAIN CIRCUIT BREAKER FOR SUB. STA. 1,2,3
SUB. 3 LOCATED IN BLDG. 4 SUPPLIES
SUB. 2 LOCATED IN

KAISER-FRAZER selects G-E metal-clad switchgear to power modernized parts plant. Increased safety, protection against power shut-downs are provided by this 8-compartment, 4.16-kv lineup. Switchgear has two incoming line sections, tie breaker, five feeders—each feeding a 1000-kva load center, such as Substation No. 4 in background.

Kaiser-Frazer installs one of the most

EASILY installed armored cable, in center, replaces maze of old low-voltage cables at right—saves tons of copper.



TOOL ROOM shows interlocked armor cable leading to junction box, Trumbull Flex-A-Power* bus duct with plug-in connections.

FOR SWITCHGEAR CONNECTIONS, 700 feet of interlocked armor cable were pulled into position in 45 minutes. Cable can go under, over pipes, rafters, beams.

G-E UNIT SUBSTATION, one of five 1000-kva Pyranol* 4160-480Y/277 load centers in Kaiser-Frazer plant, powers nearby machines. Rail protects substation from battering of trucks.

modern plant power systems in America

New G-E metal-clad switchgear and radial load-center distribution system replace obsolete low-voltage system

In modernizing a factory in Dowagiac, Mich., for use as a parts plant, Kaiser-Frazer Company turned to General Electric for a complete electrical job.

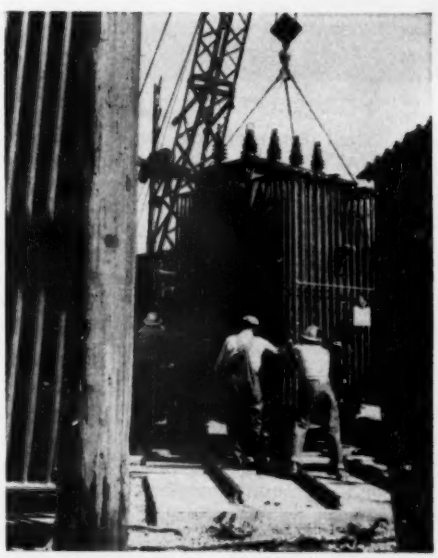
A very important phase was the G-E engineered distribution system, installed by Koontz-Wagner Electric Company, Inc., of South Bend. This system features new, standardized metal-clad switchgear . . . replaces dangerous, inadequate equipment inside and outside the factory.

Two 3000-kva transformers, equipped with load ratio control, feed metal-clad switchgear through flexible interlocked armor cable. The compact, safe, metal-clad lineup, rated at 4.16-kv, in turn feeds five 1000-kva load centers in a reliable radial distribution system. High-voltage fluorescent lighting considerably reduces equipment costs. Neutral grounding increases system reliability and economy.

Kaiser-Frazer, with pre-assembled G-E equipment, has saved months of time, cut installation and maintenance costs, provided greater safety, and made the best possible use of plant space.

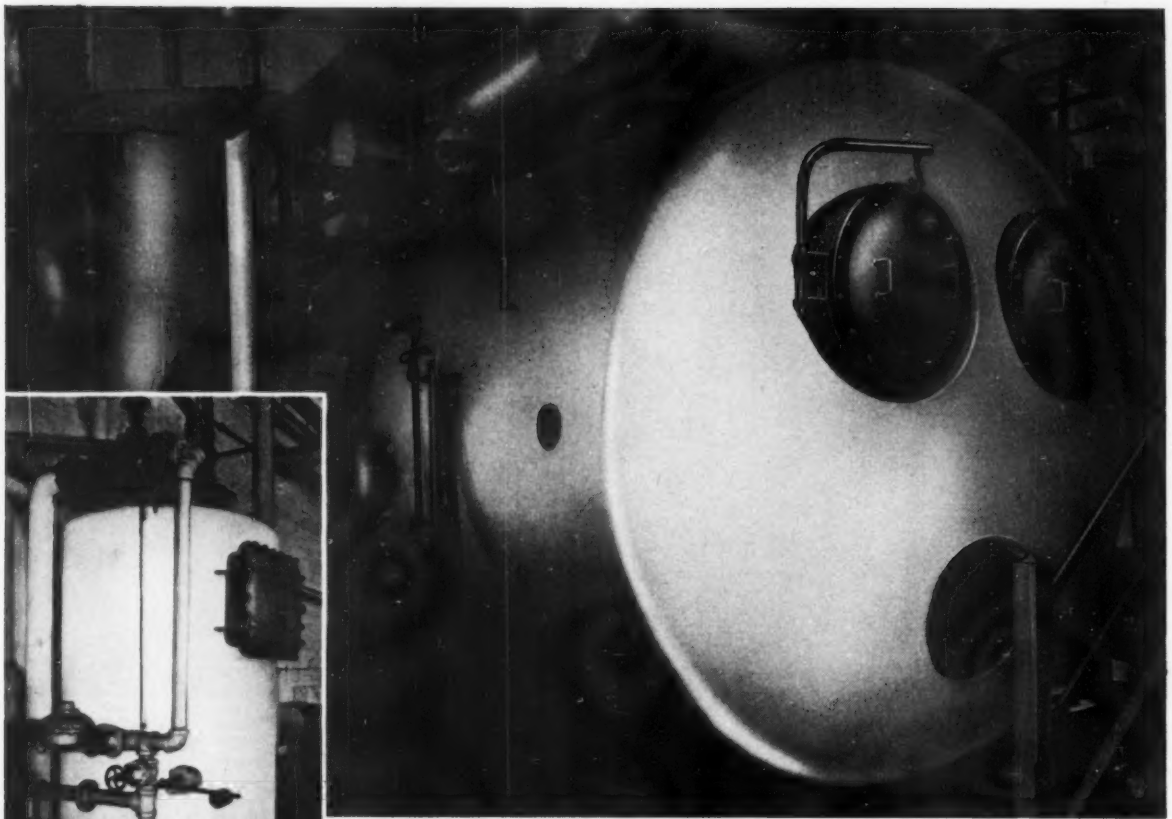
For information to help in your modernization plans, contact your local G-E sales representative—or write direct to General Electric Company, Schenectady 5, N. Y. 874-1

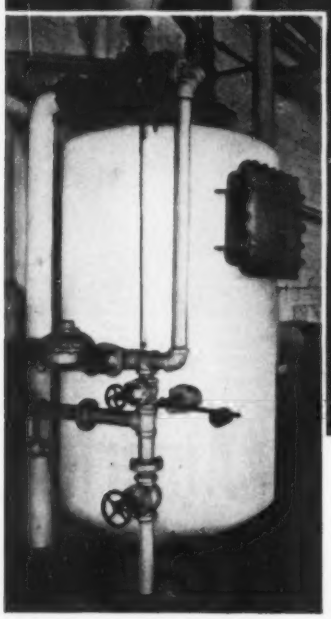
*Reg. Trademark of General Electric Company.



TWO TRANSFORMERS, 3000-kva, 27-4.16-kv with load ratio control, are installed by contractor.

GENERAL ELECTRIC





A Big Help

on small—as well as big—deaeration jobs

Small deaerators are big business at Worthington! That's why the plant with small-capacity requirements will benefit by getting acquainted with the complete range of Worthington deaerating equipment.

Worthington Gives You All Types, All Sizes

Worthington deaerating heaters and deaerators are built in sizes to handle from a few thousand pounds an hour to over a million. They are tailor-made to fit the particular requirements of each job. Special designs are available for operation with scale-forming water.

Both tray and steam-jet types are made—with external surface-type vent condensers or internal direct-contact vent condensing. They can be furnished for any practical operating pressure—constant or variable—or for vacuum operation.

With a complete range of sizes and types at their fingertips, Worthington engineers can competently recommend the design best suited to *your* requirements.

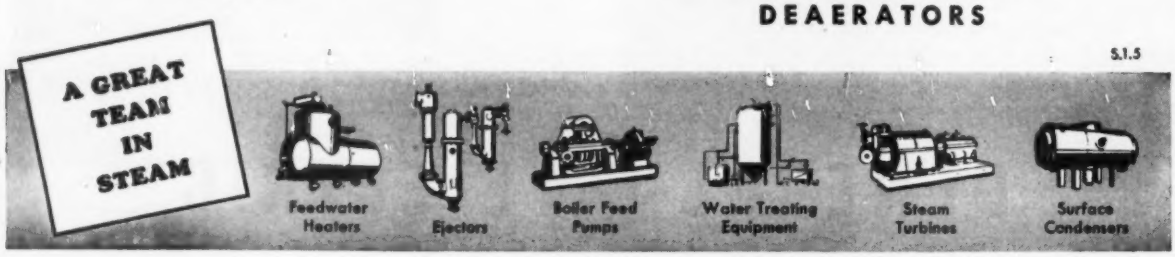
Remember, too, Worthington designs are backed by over 50 years experience in the design and manufacture of direct contact feedwater heaters and over 100 years experience in hydraulic machinery.

Send your water treating problem to Worthington Corporation, Steam Power Division, Harrison, N. J.

WORTHINGTON

DEAERATORS

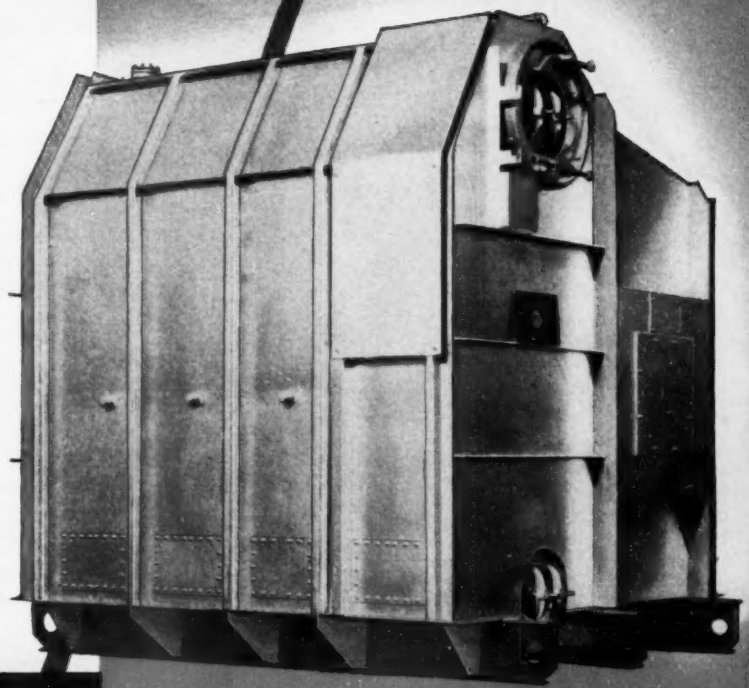
S.1.5

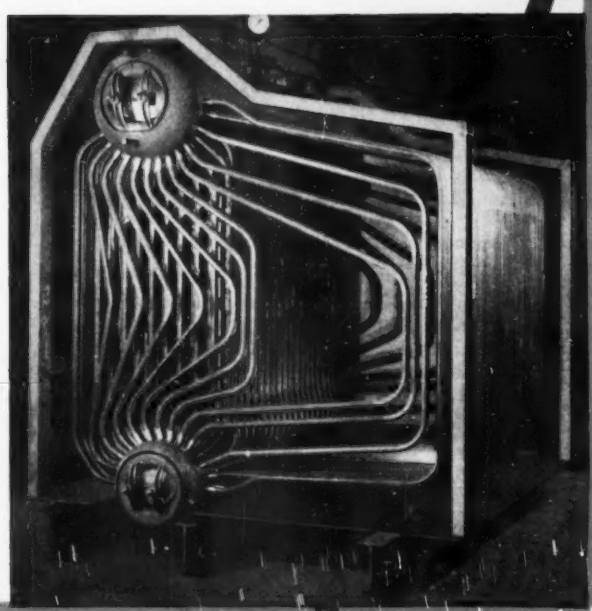


Announcing

SPRINGFIELD
PACKAGE TYPE BOILERS

HERE is Springfield's new Package Type Boiler designed especially to meet many of today's requirements for steam and high temperature hot water in industry, power, and government projects. This new line has had the benefit of more than five years of field testing and development work. Boilers are now available in a range of sizes from 7,500 to 30,000 lbs. of steam per hour, or equivalent water ratings in B.T.U., and in design pressures of 200, 300, 600, and 900 psig. These units combine all the advantages of compact, standardized, portable package boilers with the high efficiency and rugged reliability of Springfield's water tube design. ***Let us give you complete information now.***





WATER COOLED FURNACE—Tangent water tubes completely shield full length combustion chamber. Long gas travel; low exit temperature.

INTEGRAL BENT TUBE DESIGN—No separate headers. Large water capacity gives generator exceptional ability to handle heavy peak and fluctuating loads.

DRY STEAM—Special purifier-type drum baffling insures high steam quality.

STEEL JACKETED, INSULATED—Shop tested for absolute gas tightness. Suitable for outdoor or indoor installation.

SHOP OR FIELD ASSEMBLY—When necessitated by limited wall openings, Springfield's unique, insulated sectional casing and standardized sectional parts permit field assembly with minimum field labor.

OIL, GAS, OR COMBINATION FIRING—Can be furnished with complete burner and control assembly or boiler can be purchased separately, enabling user to select make and type of burners and controls desired in specification.

SPRINGFIELD BOILER CO.

1953 East Capitol Avenue • Springfield, Illinois

BENT TUBE BOILERS • STRAIGHT TUBE BOILERS • SUPERHEATERS
DESUPERHEATERS • AIR HEATERS • ECONOMIZERS • PACKAGE BOILERS

FOUNDED SPRINGFIELD BOILERS IN 1890

Built to Springfield Standard of Quality

What's New IN BOILER

Yarway Remote Liquid Level Indicator, manometric type, with automatic temperature compensation.

IMPROVED *WIDE VISION* REMOTE LIQUID LEVEL INDICATOR

A new-type face on the Yarway Remote Liquid Level Indicator now permits side as well as head-on dial readings. This vastly improved visibility makes it possible to check boiler water levels from most any position in the control room, or wherever the Yarway Remote Indicator may be installed.

MANOMETRIC TYPE

The Yarway Indicator is a manometric type with automatic temperature compensation. Level readings are instant and accurate because the indicator is operated by the boiler water itself. The indicating mechanism is never under pressure. There are no stuffing boxes.

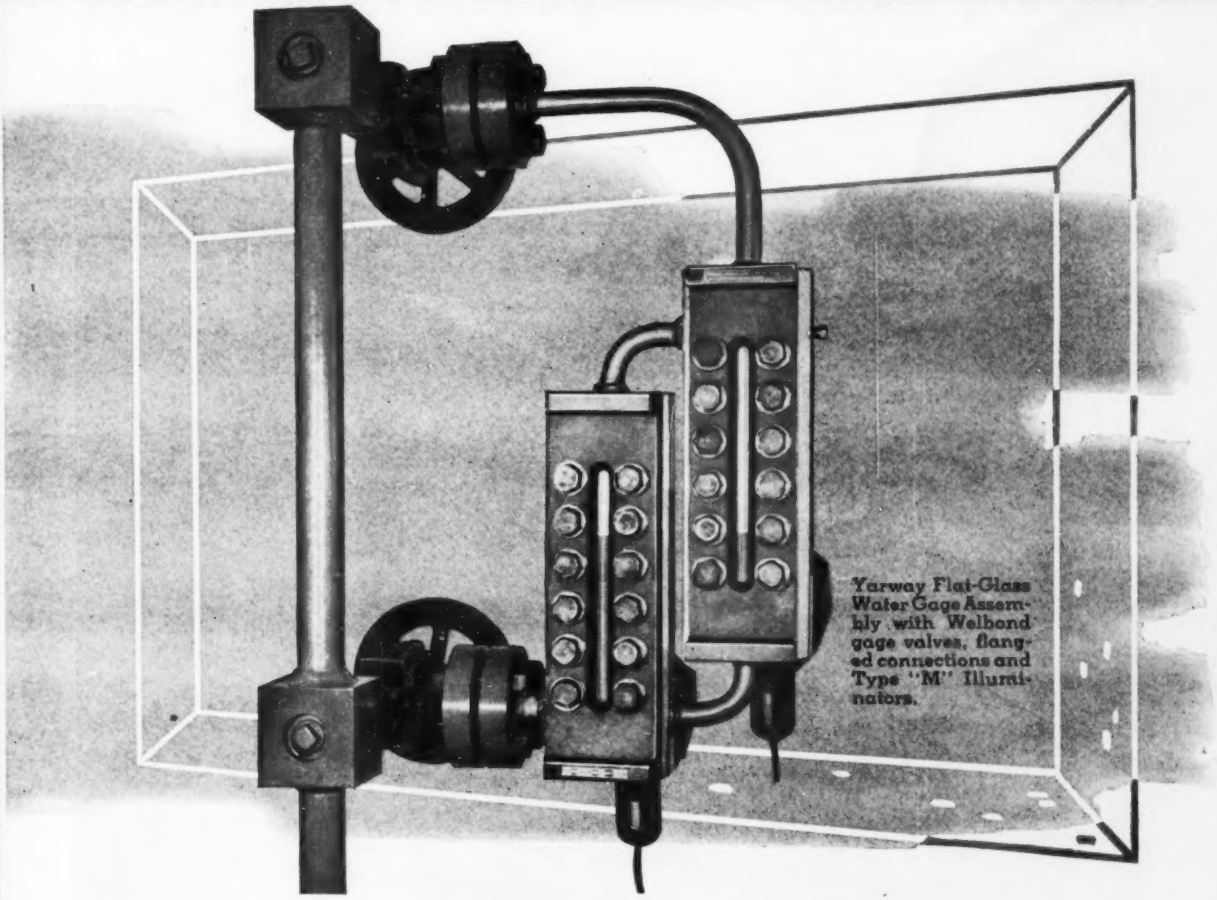
Over 8,000 Yarway Remote Liquid Level Indicators are successfully operating throughout industry — primarily for indicating boiler water levels, but also for many other liquid level applications, and for superheater pressure differential indication aboard ship.

For full information on Yarway Indicators, write for Yarway Bulletin WG-1823.

YARNALL-WARING COMPANY • 100 Mermaid Avenue, Philadelphia 18, Penna.

YARWAY®

WATER LEVEL INDICATION?



Yarway Flat-Glass Water Gage Assembly with Welbond gage valves, flanged connections and Type "M" Illuminators.

NEW *SEPARATED-DESIGN* WATER GAGES

This new Yarway water gage assembly has been developed to meet the demands for greater dependability, longer life, and more accurate readings in high pressure service.

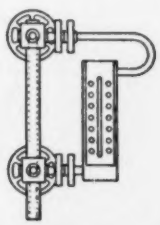
The gage glass inserts are of the Yarway pressure-sealed "floating assembly type". Yarway Welbond gage valves are used. Greater flexibility is gained by using two independent inserts, and by interconnecting expansion loops (see above).

The short connection to the drum assures greater accuracy of the gage reading, and the lower flanged connection eliminates a stuffing box. The upper flanged loop connection between the insert and gage valve allows expansion and contraction of the various components.

The tie bar-type water column linking the gage valves provides circulation to keep gage nearer drum temperature.

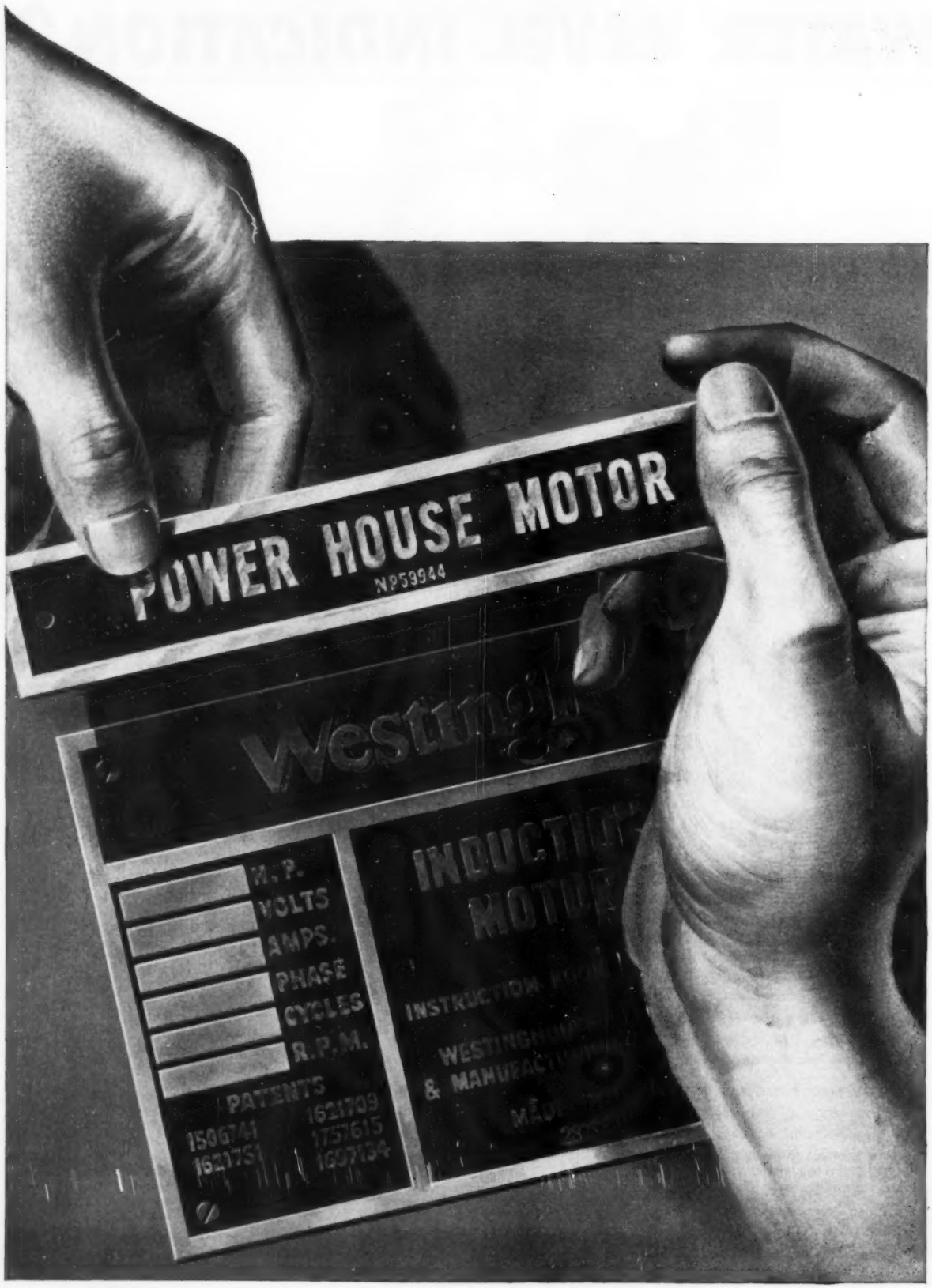
Yarway Type "M" Illuminators on the gage inserts cause the meniscus at water level to "shine like a star". This illuminator is especially effective in penetrating deposits on gage glass, dust particles in air and extraneous light.

For full information, write for Yarway Bulletin WG-1811.



Yarway Single Insert type gage for medium range of visibilities.

STEAM PLANT EQUIPMENT


POWER HOUSE MOTOR
H. P.
VOLTS
AMPS.
PHASE
CYCLES
R.P.M.
PATENTS
1506741
1621709
1757615

What this Westinghouse name plate means to you

When you see this name plate you are looking at a symbol of motor craftsmanship applied to the complete line of Westinghouse Power House Motors ranging from 1 to 3000 hp. Each of these motors are specially built to meet power station conditions. They are given extra protection and special inspection to assure longer life.

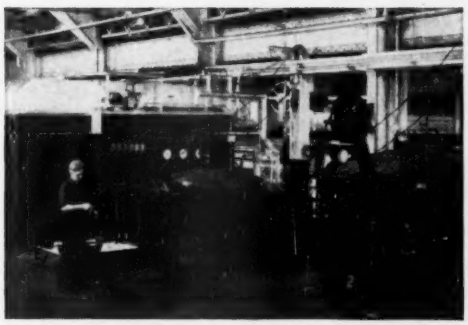
Westinghouse engineers analyze the requirements of each power station auxiliary before the motor is specified. Then a special order is written outlining the design and construction details needed for each motor. As the motor is built, the component parts are tested for highest quality workmanship.

For fullest protection, two extra dip-and-bake varnish treatments are specified for the windings of all Power House Motors except those that are totally enclosed. This special thermoset varnish gives a hard, dirt and grease-repelling finish to stand up to power house conditions.

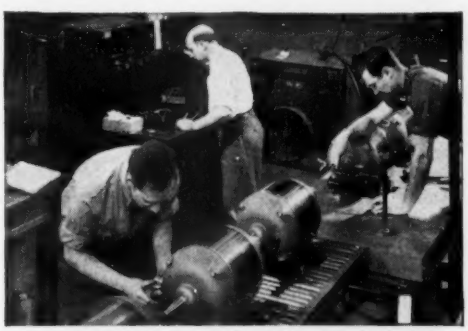
The best way to know the Westinghouse Power House Motor line is to inspect nearby installations. Call your Westinghouse representative for the location of an installation near you, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21719

YOU CAN BE SURE...IF IT'S

Westinghouse



Windings receive two extra dip-and-bake treatments in special varnish for full protection against dirt and grease.



After assembly, each Power House Motor is given a four-hour operating test and complete inspection by the Quality Control Department.

Air-gap check is part of the final inspection given each Power House Motor. Split-shell bearings and bearing housing make inspection easier.

Harnessing heat for all industry

HEAT is one of man's most useful servants. With it, he can separate gasoline from crude oil . . . cook food . . . generate electricity . . . refine steel from raw ore and roll it into mile-long sheets. But to do these and countless other jobs, heat must be applied in the correct amounts . . . to obtain critical temperature values.

Forward-looking research and production men realized some years ago that "rule of thumb" was entirely inadequate for replacing complex processes. They needed facts obtainable only from automatic measurement . . . performance possible only through automatic control.

Honeywell has consistently led the way toward new and better temperature instrumentation. Continuing research has developed sensing elements which cover the full temperature spectrum . . . instruments which provide the desired accuracy . . . and automatic controls which can regulate any production process.

instruments

The complete Honeywell family offers a broad choice of characteristics to suit individual applications. *ElectroniK* indicators, circular chart and strip chart recorders and controllers afford the peak in performance through "Continuous Balance" high-speed electronic measurement. *Pyr-O-Vane* millivoltmeter instruments fit many processes which need accurate indication and control. Brown Thermometers are economical instruments for recording and controlling moderate temperatures.

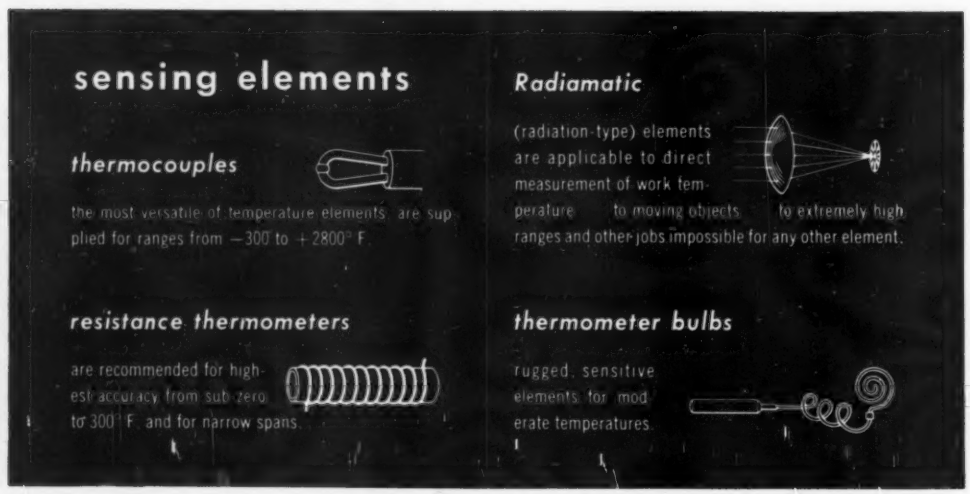
controls

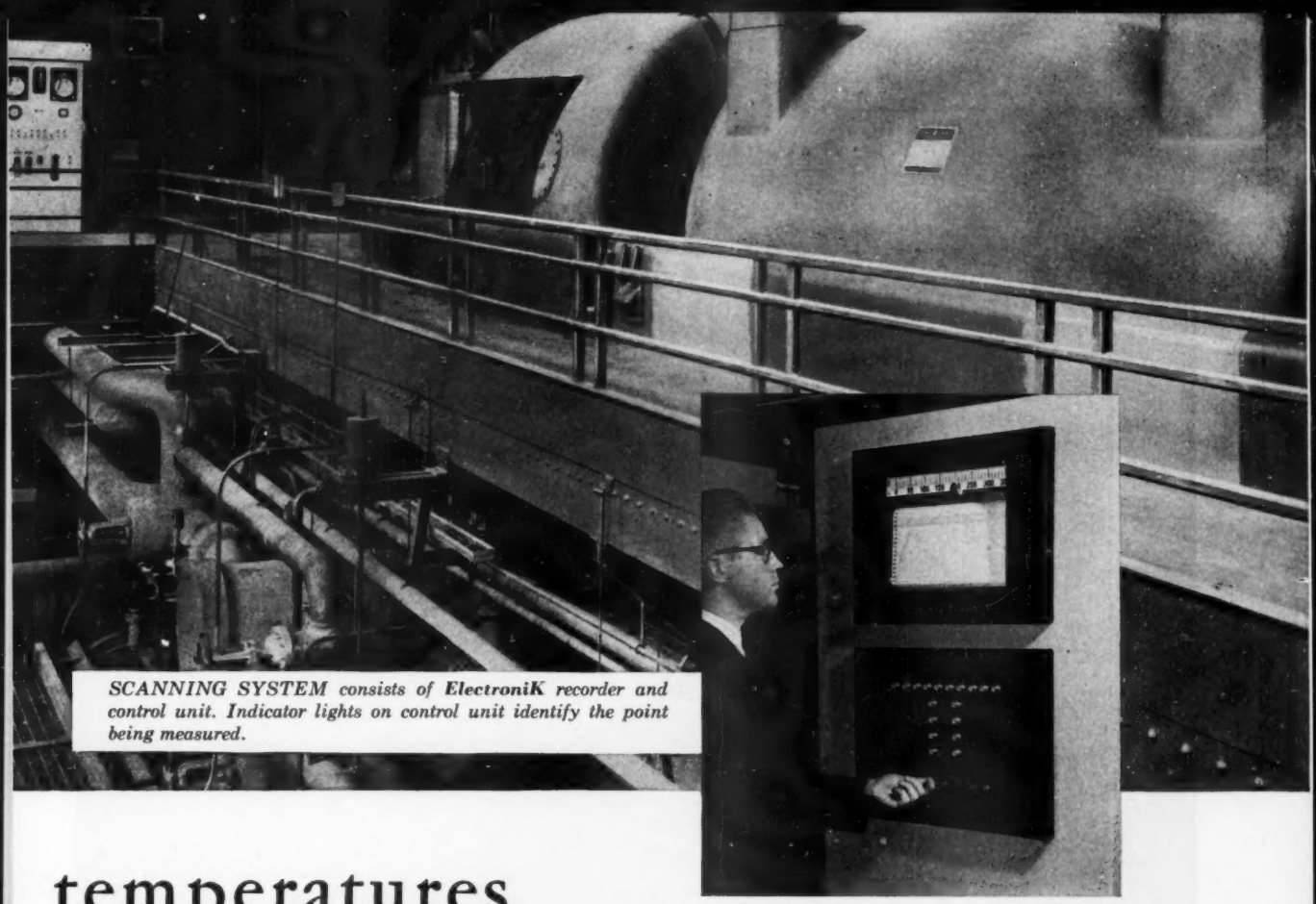
With *Pyr-O-Vane* instruments you can have electric control of either the two-position, three-position or time-proportioning types.

With Thermometers, you may choose from electric two-position, pneumatic on-off or proportioning control, and cam-operated program control.

With *ElectroniK* instruments, your selection covers practically any form of electric or pneumatic control, including the most advanced types suitable for complex processes, and the most flexible program controls.

Watch 270 plant *with the*


sensing elements
thermocouples
the most versatile of temperature elements, are supplied for ranges from −300 to +2800° F.
resistance thermometers
are recommended for highest accuracy from sub-zero to 300° F. and for narrow spans.
Radiamatic
(radiation-type) elements are applicable to direct measurement of work temperature, to moving objects, to extremely high ranges and other jobs impossible for any other element.
thermometer bulbs
rugged, sensitive elements for moderate temperatures.



SCANNING SYSTEM consists of ElectroniK recorder and control unit. Indicator lights on control unit identify the point being measured.

temperatures *ElectroniK* scanner

IT'S EASY and economical to keep constant watch over temperatures of potential trouble spots throughout the plant, when you have an *ElectroniK* Scanning System. From a central point, you can monitor temperatures of bearings, hydraulic couplings, boiler tubes, cooling oil lines . . . at surprisingly low cost per point.

This instrument can concentrate data from as many as 270 different locations. It scans through successive thermocouple points at a rate as fast as one second per point . . . re-checking each point at approximately four-minute intervals.

At the operator's choice, it can perform these various functions: simple scanning without recording, continuous recording of all 270 points, selective recording, recording of points which depart from specified limits, and operation of annunciator contacts when any temperature exceeds a pre-set point. The chart moves only when the instrument is actually recording. Separate temperature limits can be set for each bank of 9 thermocouples.

Your local Honeywell engineering representative will be glad to discuss how this instrument can help you protect plant equipment economically. Call him today . . . he is as near as your phone.

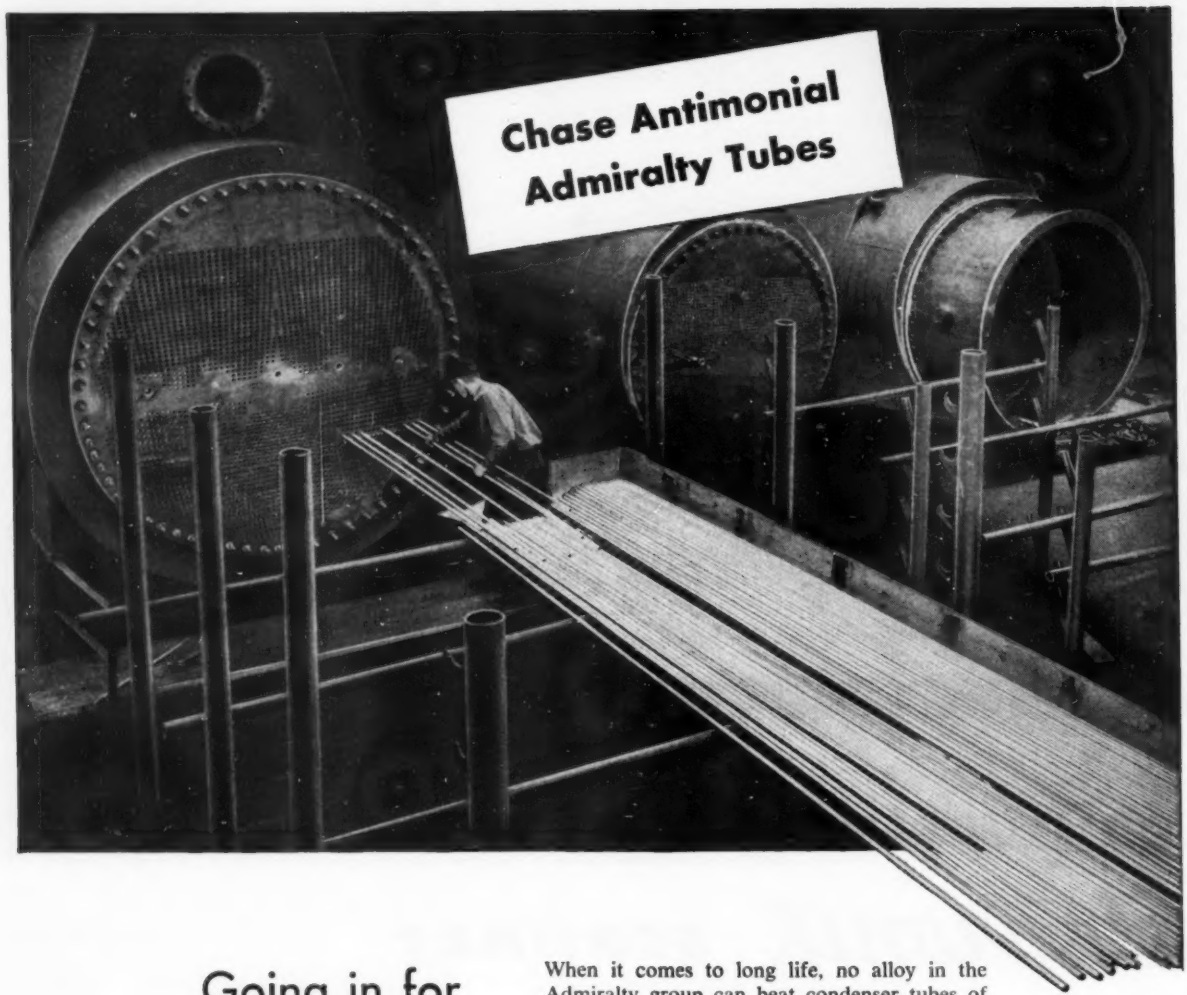
MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4490 Wayne Ave., Philadelphia 44, Penna.

● **REFERENCE DATA: Write for Data Sheet No. 10.0-9, "*ElectroniK* Scanning System," and Catalog 90-2, "Supervisory Instruments for Power Generation."**

MINNEAPOLIS **Honeywell**

BROWN INSTRUMENTS

First in Controls



Going in for years of service

When it comes to long life, no alloy in the Admiralty group can beat condenser tubes of Chase Antimonial Admiralty.*

Because these tubes have *enough* antimony, they resist dezincification. And antimony as an inhibitor doesn't affect the grain structure . . . will not weaken the tube.

For more information about long-lasting Chase Antimonial Admiralty . . . send coupon for FREE book on Condenser and Heat Exchanger Tubes.

CHASE WAREHOUSE STOCKS: *NEW YORK, BALTIMORE, NEW ORLEANS, LOS ANGELES.* Also carried by *Vinson Supply Co., Tulsa; Standard Brass & Mfg. Co., Houston.*

*U.S. Pat. No. 2,061,921

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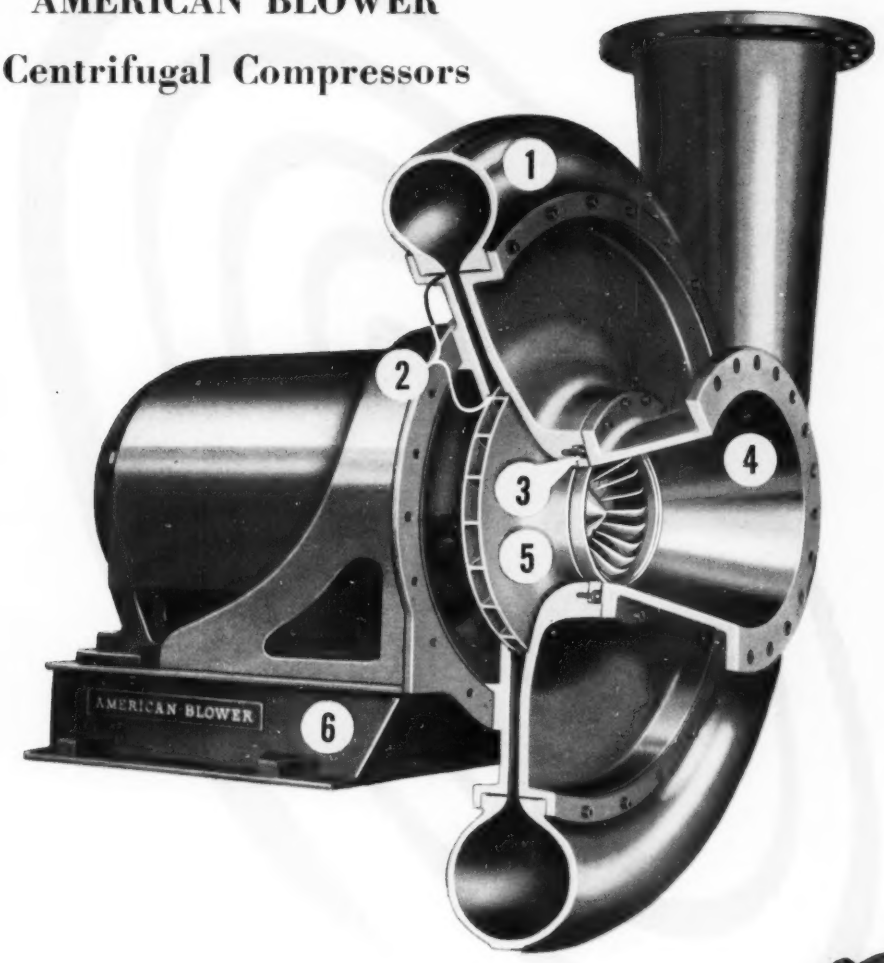
AMERICAN BLOWER

Centrifugal Compressors



American Blower Centrifugal Compressors offer outstanding design features which improve efficiency, facilitate installation and minimize maintenance.

In the cutaway view, above: (1) Improved, scroll-shaped, casing design increases compressor efficiency. (2) Unobstructed diffuser passage efficiently converts velocity energy into pressure. (3) Annulus packing, having machined labyrinths, minimizes recirculation of gas around the impeller inlet. (4) Removable inlet nozzle. (5) Aerodynamic design of impeller blades results in high efficiencies. (6) Welded-steel baseplate "stress relieved" prior to machining, assuring maintained alignment.

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American Blower Single Stage Centrifugal Compressors are available in sizes 30 to 600 h.p., and pressures 1¼ to 3¾ lbs.

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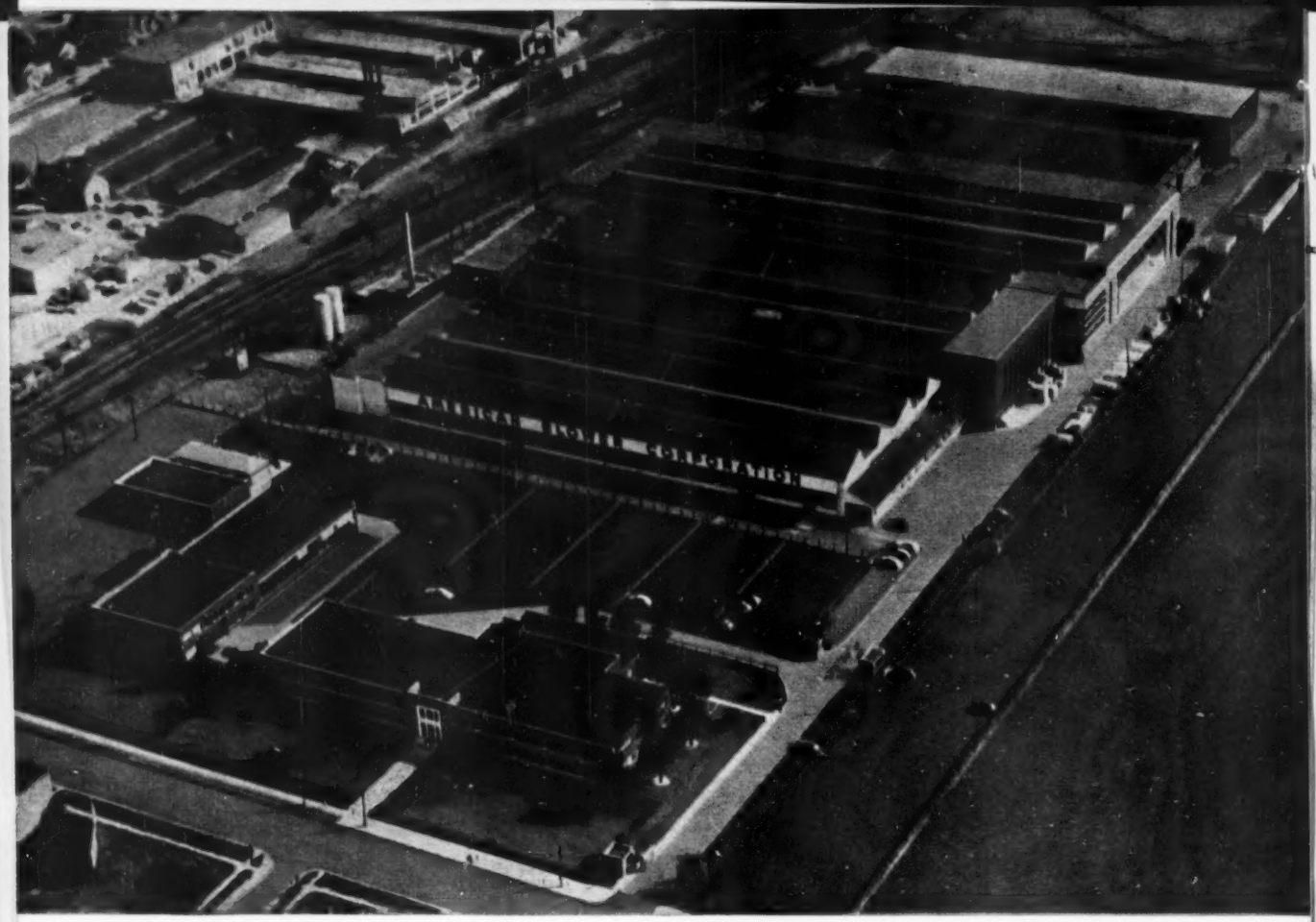

American Blower main plant and office, Dearborn, Mich. Here are located the finest research and sound laboratories and engineering facilities in the industry.

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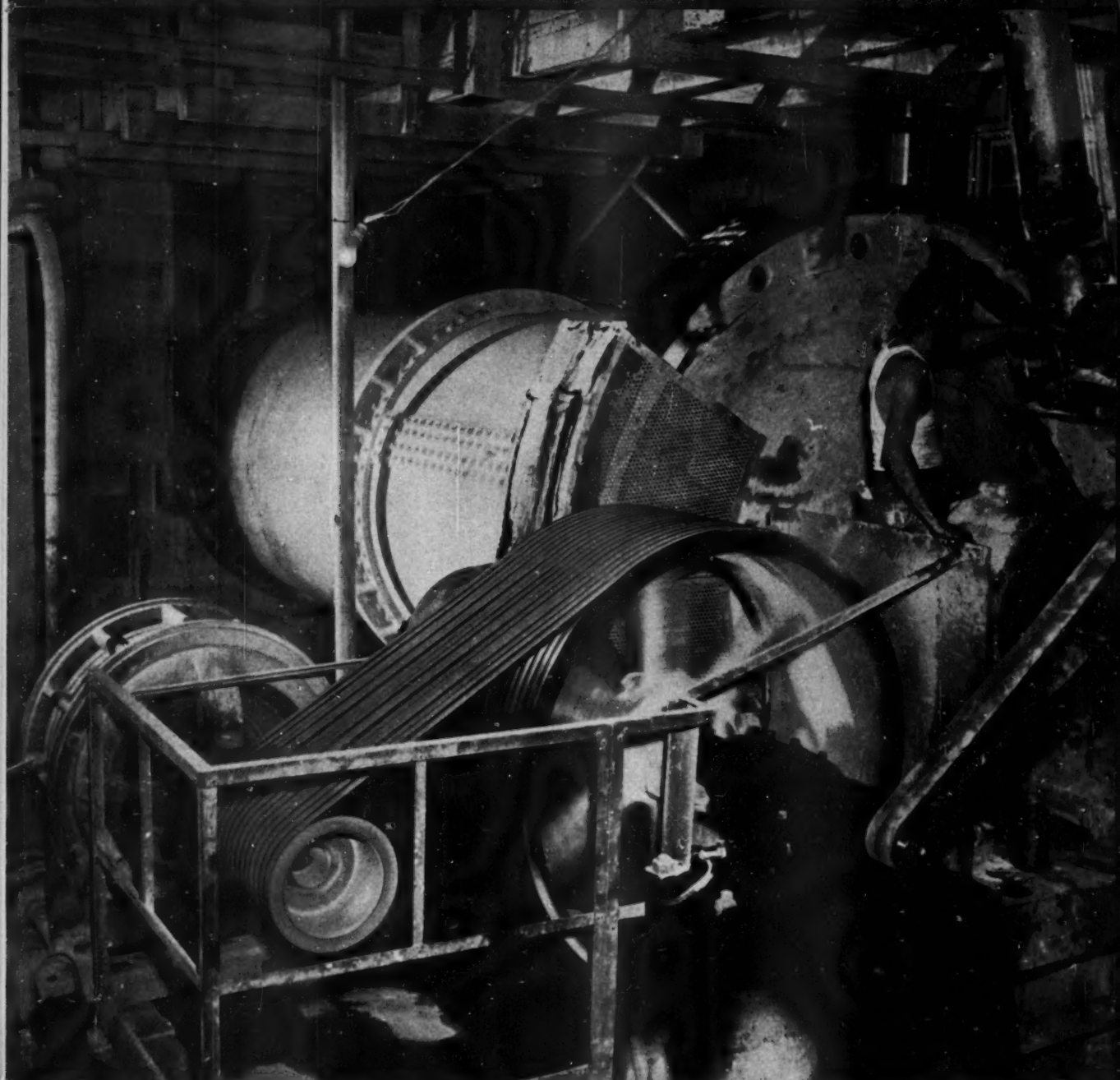
B.F.Goodrich GROMMET BELTS AT WORK



It's so hot in this ball mill grinding hot sand that the fire sprinkler system, set at 190°, occasionally pops off.

Belts boil in hot sand mill

The V belts driving this ball mill help grind hot sand, heated to 260°, to a fluffy powder used for fine glass, pottery, cosmetics. Ordinary V belts couldn't stand the withering heat and heavy loads, were lasting only one or two years. It took an entirely different kind of belt to solve this problem of frequent replacement — as shown on the following pages.

Belts boil (continued)

It takes seventeen rubber muscles to turn the huge ball mill. Hot sand goes into cosmetics to make pretty girls prettier.

The problem described on the preceding page was solved when a set of B. F. Goodrich grommet V belts was installed. When the picture was taken, they had already lasted five years, and still looked good for more service. One reason why BFG grommet V belts last longer is that they stay cooler by generating less internal heat than ordinary belts, and are made of a rubber that stands boiling temperatures.

20 to 50% Longer Life

Patented grommet V belts by B. F. Goodrich represent the only basic improvement since invention of the V belt. Belts last 20 to 50% longer, de-

pending on the service. (The more severe the service the greater the increase over ordinary belts.)

What is a grommet?

A grommet is like a giant cable except that it's endless—a cord loop built up by winding heavy cord on itself. There is no overlapping cord *section* as in all ordinary belts. Most belt failures occur in these sections where cords overlap!

All Cords Put to Work

In ordinary belts under high tension the center cords "dish" and tension is greater near the driving faces. Dished cords are doing less work, not pulling their share. Each grommet and every part of a grommet carries its share of the load. Grommet V belts have no center cords—therefore much more strength in proportion to cord volume.

Better Grip, Less Slip

Grommet V belts have more rubber in relation to belt size. Without any stiff overlap, they're more flexible, grip pulleys better. Size for size, grommet belts give ⅓ more gripping power, pull heavier loads with a higher safety factor. Because there is less slip there is also less surface wear.

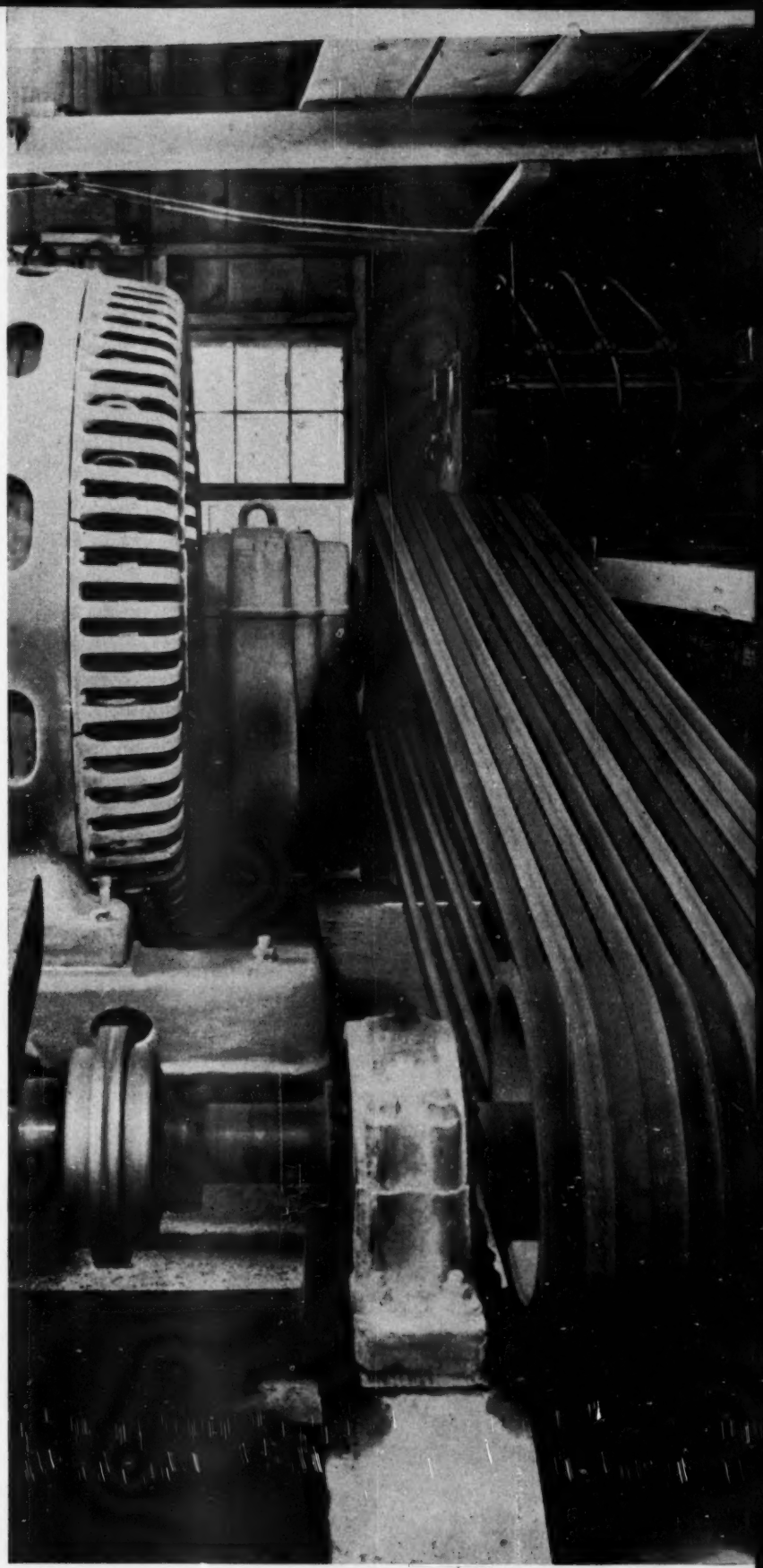
They Cost No More

You save belt costs because belts last longer, save production costs because machines keep running with fewer interruptions, save maintenance costs because they need less attention, yet cost not one cent more than others. Grommet belts are made in C, D and E sections. Only B. F. Goodrich makes the grommet V belt. (U. S. Patent No. 2,233,294).

Mile a minute

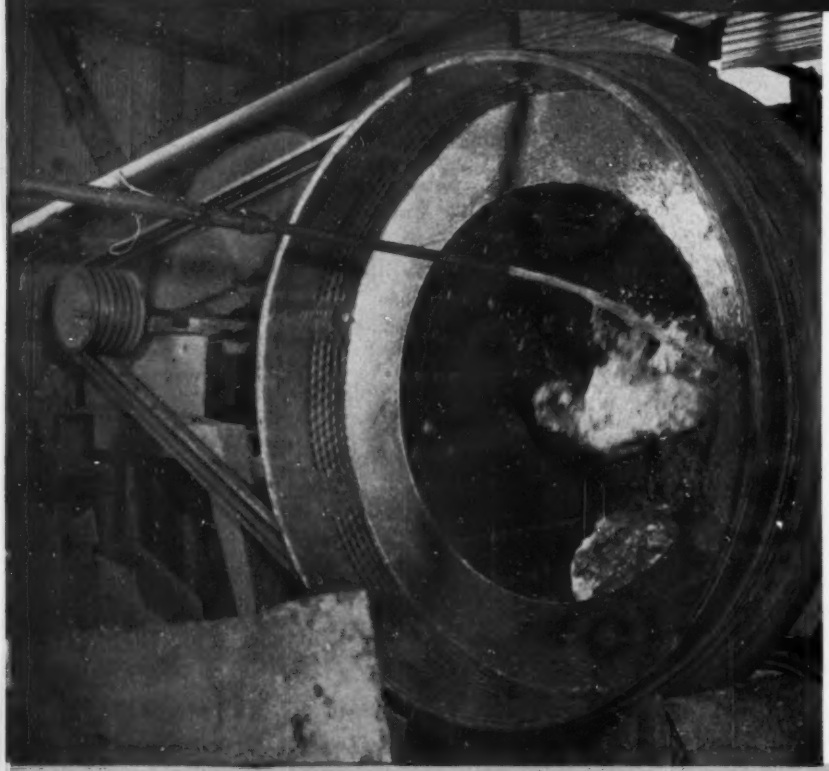
This is where they make power to run the machinery used to turn a whole stone mountain into pieces used in buildings—so much power, in fact that the belts driving the generator have to travel a mile a minute. At that speed engineers questioned whether V belts could do the job.

B. F. Goodrich engineers studied the problem, said that grommet V belts could handle it. When this picture was taken B. F. Goodrich grommet V belts had been in service three years—looked good for much more. The owner says they cut costs more than 40%.



Rubber runs a mile a minute to cut a mountain into chunks.

B.F.Goodrich GROMMET BELTS AT WORK



Break it up

That cagelike contraption spins like a top all day long, breaking up a special kind of rock used in making glass. But the jolting action is rough on the V belts used to turn the breaker. Belts used to wear out too soon, usually after only two months' work. Then grommet V belts were tried. And because they stand up to shocks and heavy loads, the grommet belts are lasting 30% longer than any belts ever used before, and they also do a better job of running the breaker.

← *Spinning big boulders into little rocks.*

These typical examples (see preceding pages) tell you why B. F. Goodrich grommet belts are superior to ordinary V belts — prove they last 20 to 50% longer—yet cost no more.

Grommet V Belts BY
B.F.Goodrich
FIRST IN RUBBER

The B. F. Goodrich Company, Industrial Products Division, Akron, Ohio

New G-E Boiler-feed-pump Motor

A true power station motor from top to bottom, General Electric's new Boiler-feed-pump Motor offers you many features—among them:

- **Cubical shape reduces width.**
- **Air discharge out top permits mounting motors closer together, improves employee comfort.**
- **Streamlined rotor improves performance—is quieter.**
- **Modern appearance blends with power station styling.**

For more complete information, ask your G-E representative for Bulletin GEA-5813, or write Section 753-1, General Electric Company, Schenectady 5, N. Y.

You can put your confidence in—

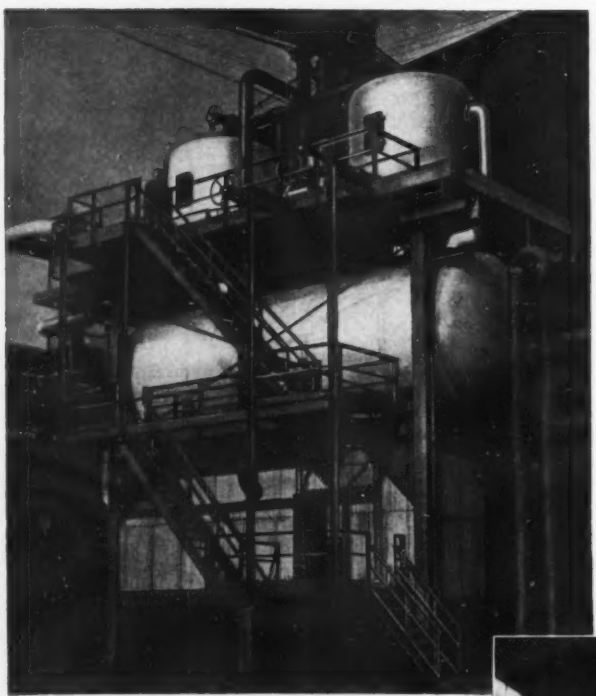
GENERAL ELECTRIC

GRAVER

Deaeration for all!

from under 5,000 lb per hr to over 1,000,000 lb per hr

Whether your plant is large or small, the wide range of Graver Deaerating Heaters assures a correct selection for your particular operating conditions. Graver Heaters are available in spray or tray types, or a combination spray-tray type, equipped with either external or internal vent condensers.

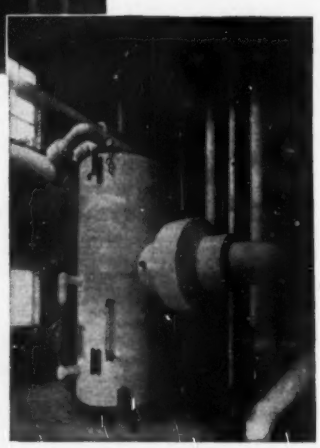


← **For the large capacity plant**

Graver Deaerating Heaters are serving high-pressure high-temperature central power stations and large industrial plants all over the country. Even with difficult operating conditions such as variable load and corrosive water, Graver installations uniformly exceed guarantees and operate with complete satisfaction, minimum attention, and negligible maintenance expense.

→ **for the small capacity plant**

Standard designs of Graver small Deaerating Heaters are specially engineered for the same low-oxygen guarantee carried by the larger and more expensive Graver Heaters. These small Graver units provide complete deaeration at a low cost that is quickly returned by savings in plant operation, maintenance and outage costs.



Investigate Graver Deaerator corrosion protection for your plant. Specific recommendations are offered without obligation. Write for your copy of "Trends in Application of Deaerating Heaters for Treatment of Boiler Feedwater".

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easy to remove
separate units

easy to read—
no glare, no parallax

Available in four mountings

Semi-flush mounting

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Projected mounting

easy zero check
from the front

exclusive magnetic access
door—no screws, latches, handles

the HAYS *Vertiscale*

You designed this draft gage! You asked for these features!
Accessibility from the front makes possible easy "one man" method of quickly checking zero. (The fast 3-way cock with test fitting is *standard* on the Hays Vertiscale).
Simple maintenance—individual units can be quickly removed for inspection or adjustment. Removal does not affect other units in the case, does not disturb calibration of unit being re-installed.
No parallax—design eliminates reflections regardless of viewing angle.
No glare—internal fluorescent lighting is standard.
You get all these values *plus* functional styling in the Hays Vertiscale draft gage!
Write today for full information on the Hays Vertiscale Bulletin 52-1060-210.

Automatic Combustion Control
Boiler Panels • Hays-Penn Flowmeters
Veriflow Meters and Veritrol
Gas Analyzers • Draft Gages
Combustion Test Sets • CO_2 Recorders
Electronic Oxygen Recorders

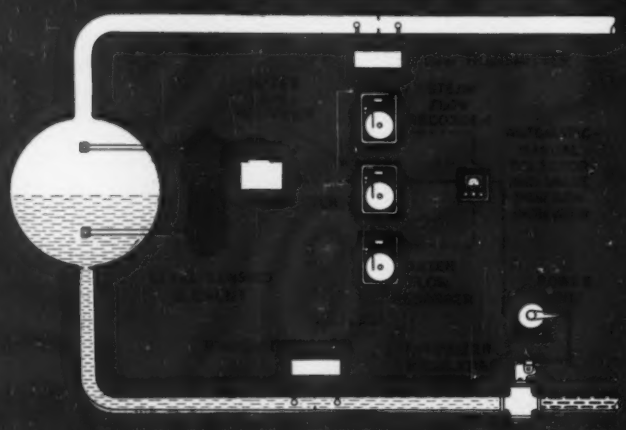
THE hays CORPORATION

MICHIGAN CITY 7, INDIANA

a new electronic feedwater control!

electronic null balance remote operation

control operative even on cold boilers



pressures up to 2500 lbs.

positive valve drive —cannot freeze

THREE ELEMENT CONTROL SYSTEM

mercury-less measuring and transmission for flow and level

1, 2, or 3 element control available

HAYS Electronic Feedwater Control

One, two, or three element control systems for all boilers, large and small, even under the most severe operating conditions.

Existing instruments can be used — steam flow meters, water flow and level meters.

Buoyant float *level measuring unit* with torsion tube — no seals or packing. Direct measure of level. No blow-down necessary for start up.

Bellows type *flow measuring unit* — no mercury. Overpressure protection — convenient range change.

Electronic *controller* for speed of transmission and accuracy of control. Independent adjustments for effects of steam flow, water flow and water level.

Fast, electronic rebalancing *recorder*. Continuous integration.

Write today for full information on the Hays Electronic Feedwater Control System Bulletin 52-1073-221.

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Electronic Oxygen Recorders
Electronic Flowmeters
Electronic Feed Water Controls
Miniature Remote Indicators

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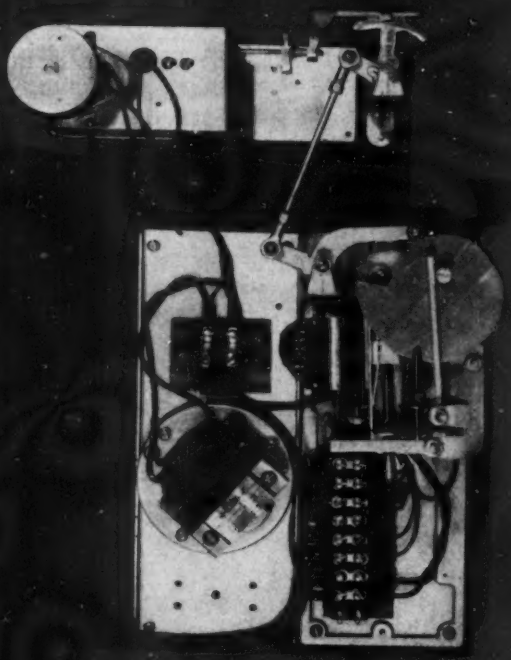
MICHIGAN CITY INDIANA

a new electronic flow meter!



continuous integration —no creep at zero

unaffected by normal voltage, frequency and temperature changes

electronic operation provides high speed and greater accuracy

3 to 1 range calibration at recorder

HAYS Electronic Flow Meter

Since the circuit is of the electronic null-balance type, it is unaffected by normal voltage and frequency variations. Also, neither temperature variations nor reasonable length of transmission lines affect the calibration of the instrument.

The *pen-drive motor* is built for reversing duty. Normal variations in voltage and frequency have no noticeable effect on its operation.

The *integrator* is continuous in operation and simple in mechanical construction. A micrometer zero adjustment for calibration is easily accessible.

Indicators can be calibrated to read directly in rate-of-flow or other factors as desired.

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a new miniature indicator!

Available with:

MEASURED VARIABLE → AIR-PILOT → COPPER TUBING

PNEUMATIC TRANSMISSION

MEASURED VARIABLE → DIFF. TRANSF. → AMPLI-FIER

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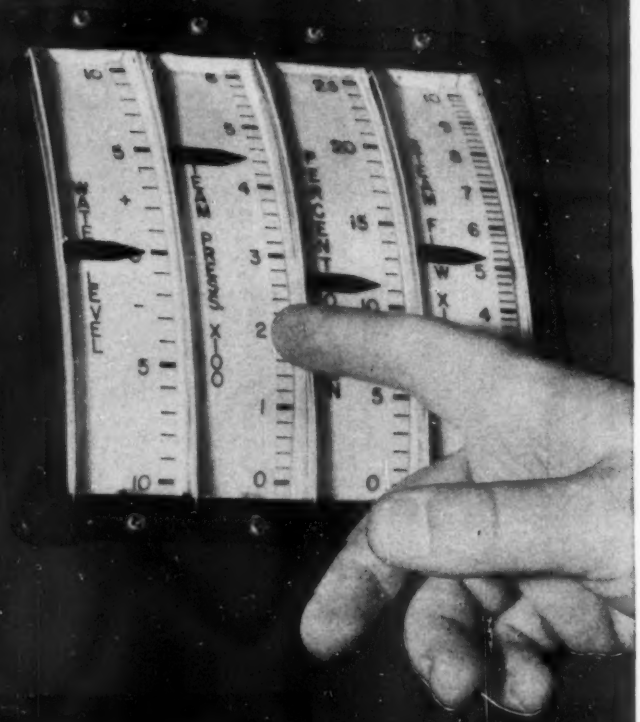

removable units—interior illumination

easy to read—5 inch scale, no parallax

easy correlation of related functions

easy zero check from the front

HAYS Miniscale Gages

This miniature instrument is especially suited for remote indication of such variables as pressure, draft, flow or level.

The scale is only 5 inches long — easy to read — internally illuminated. Choice of pneumatic or electric transmission.

Also available is the Hays direct reading miniscale gage for indicating *pressures* of fluids (steam, water, gas, oil, etc.) directly.

Gages are arranged for flush or semi-flush mounting. Either a yoke mounting, for as many as 12 units, or a keyhole clamp mounting for individual units can be provided.

Write today for full information on the Hays Electronic Flow Meter Bulletin 52-1075-223.

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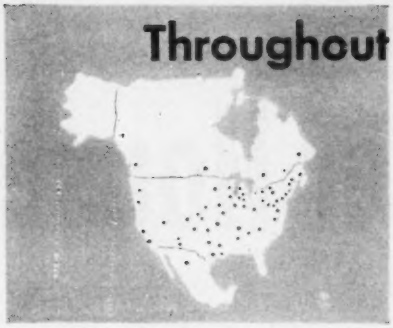

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MICHIGAN CITY INDIANA

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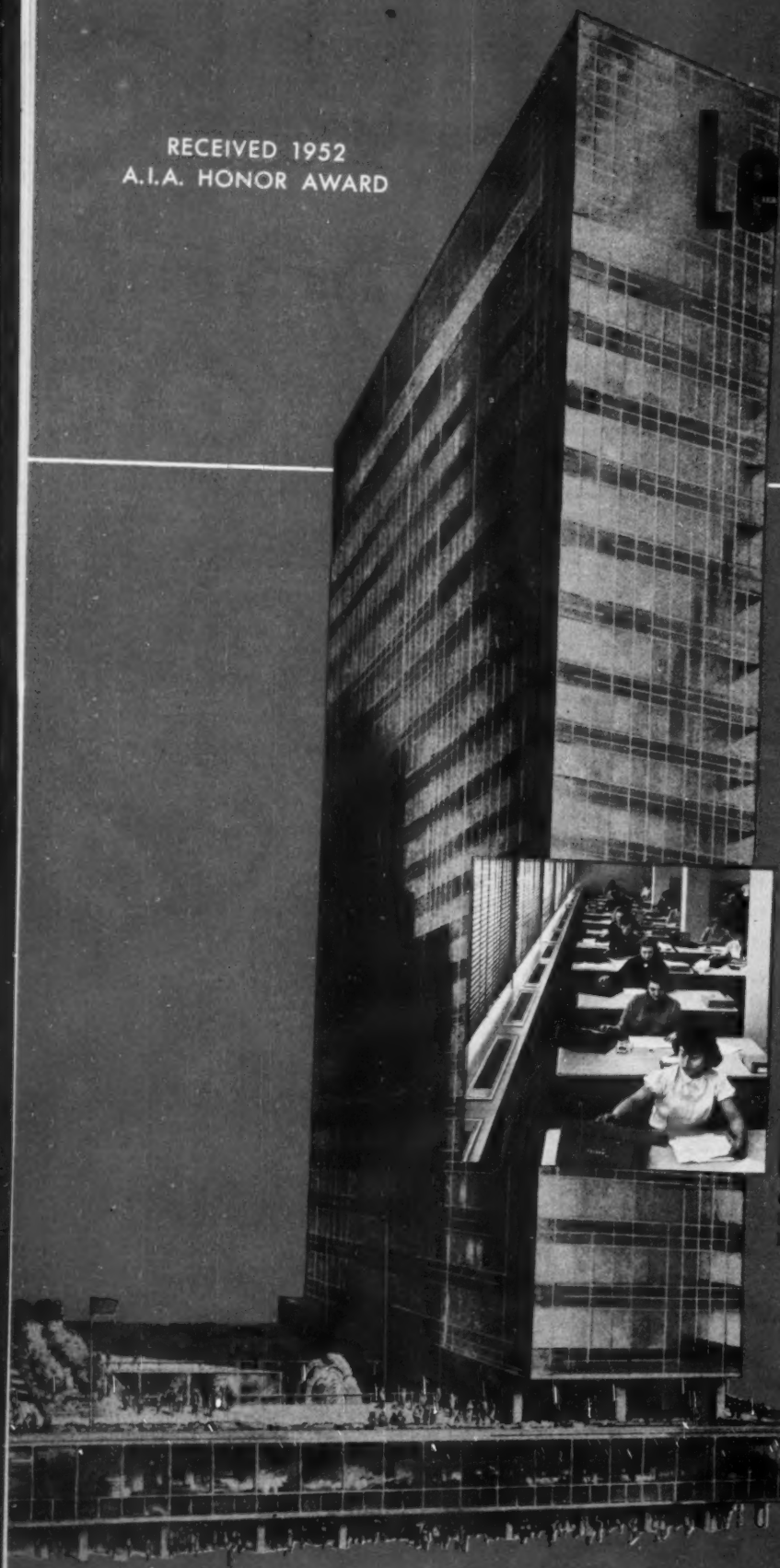
Lever House...

Architects: Skidmore, Owings & Merrill
Engineers: Jaros, Baum, & Bolles
Contractor: Kerby Saunders, Inc.



Conditioned air in interior zones is controlled by POWERS Type D Sub-Master Thermostats located on various floors.

POWERS CONTROL

another New York landmark equipped with

POWERS Pneumatic System of AIR CONDITIONING CONTROL

Individual selection of desired temperature in each office and other spaces at Lever House provides year 'round comfort with important benefits of increased employee efficiency, less fatigue, absenteeism, illness, and lower cleaning costs.

Air conditioning here is by means of a split system — individual units shown below, for the glazed periphery of the building are fed with high pressure filtered and humidified air and heated or chilled water. In the center of the office space high velocity conditioned air is distributed thru ceiling diffusers.

Right-temperatured-air at proper humidity is assured at all times by a Powers pneumatic control system. Only a few of its important controls are shown below, most are "behind the scenes" performing their tasks with unfailing dependability.

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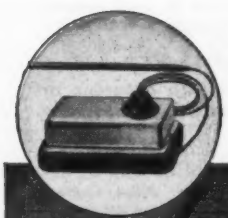
New York Times • Manhattan House • Esso Building
Harvard University • Massachusetts Inst. of Technology
Prudential Insurance Co. • Anheuser Busch Inc. Newark
Esso Research Center, Linden, N. J.
New York City Veterans Administration Hospital
Washington National Airport • LaGuardia Airport

Experience we have gained in many installations such as these may be helpful to you. When problems of temperature or humidity control arise contact POWERS nearest office, there's no obligation.

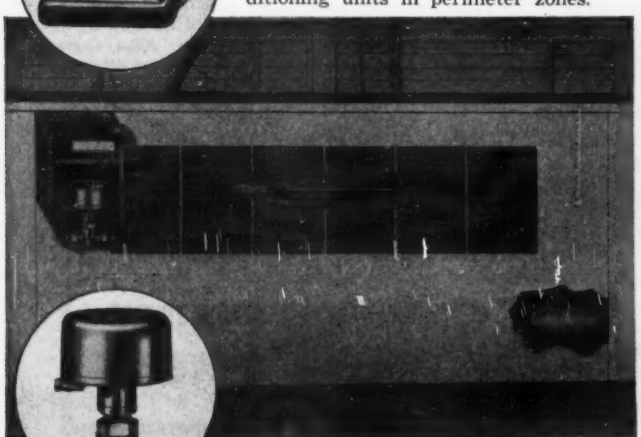
THE POWERS REGULATOR COMPANY

Over 60 Years of Automatic Temperature and Humidity Control

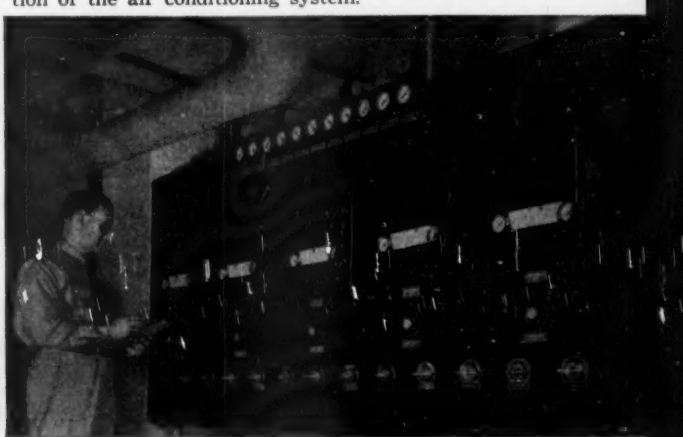
Skokie, Ill., Offices in Over 50 Cities, see your phone book

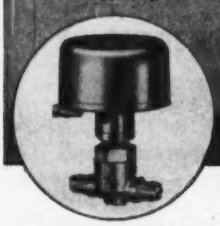


Powers Summer-Winter Thermostat and No-Pak Valve below, regulate air conditioning units in perimeter zones.



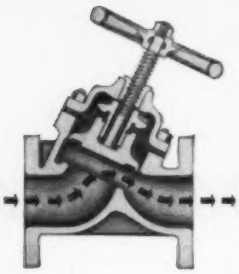
Powers Master Control Panel for primary air and water circuits plays an important part in the efficient regulation of the air conditioning system.





Powers NO-PAK Valve has unique Duo-Seal packless feature. It prevents water leakage – requires no packing maintenance.

(b4)



FOR SAFER CONTROL ⟶⟶⟶ OF HARD-TO-HANDLE FLUIDS

CRANE Packless Diaphragm Valves

Now Available in New Materials

WORKING PRESSURES—up to 150 pounds. Water, air, oil, or gas, 180°F. maximum temperature, depending on valve size and materials.

You asked for it—and now Crane gives you this outstanding Diaphragm Valve in a new wide choice of body, disc insert, and diaphragm materials—in unlined or lined patterns. Whichever is specified, Crane design gives you important advantages including—long diaphragm life . . . positive shut-off in case of diaphragm failure . . . less resistance to flow with minimum pressure drop . . . easy operation . . . simplified maintenance at lowest upkeep cost.

Full specification data is in your new Crane 53 Catalog—or ask your Crane Representative.

SCREWED ENDS, UNLINED Sizes ½ to 2 in.
Brass, Cast Iron, Aluminum, or 18-8 Mo body and disc. Furnished with neoprene, Buna N, and natural rubber diaphragm and disc insert.

FLANGED ENDS, UNLINED Sizes ½ to 6 in.
Cast Iron, Aluminum, or 18-8 Mo body and disc. Furnished with neoprene, Buna N, and natural rubber diaphragm and disc insert.

FLANGED ENDS, LINED Sizes 1 to 6 in.
Cast Iron body only. Lined with neoprene or hard natural rubber. Disc coated with neoprene or soft natural rubber.

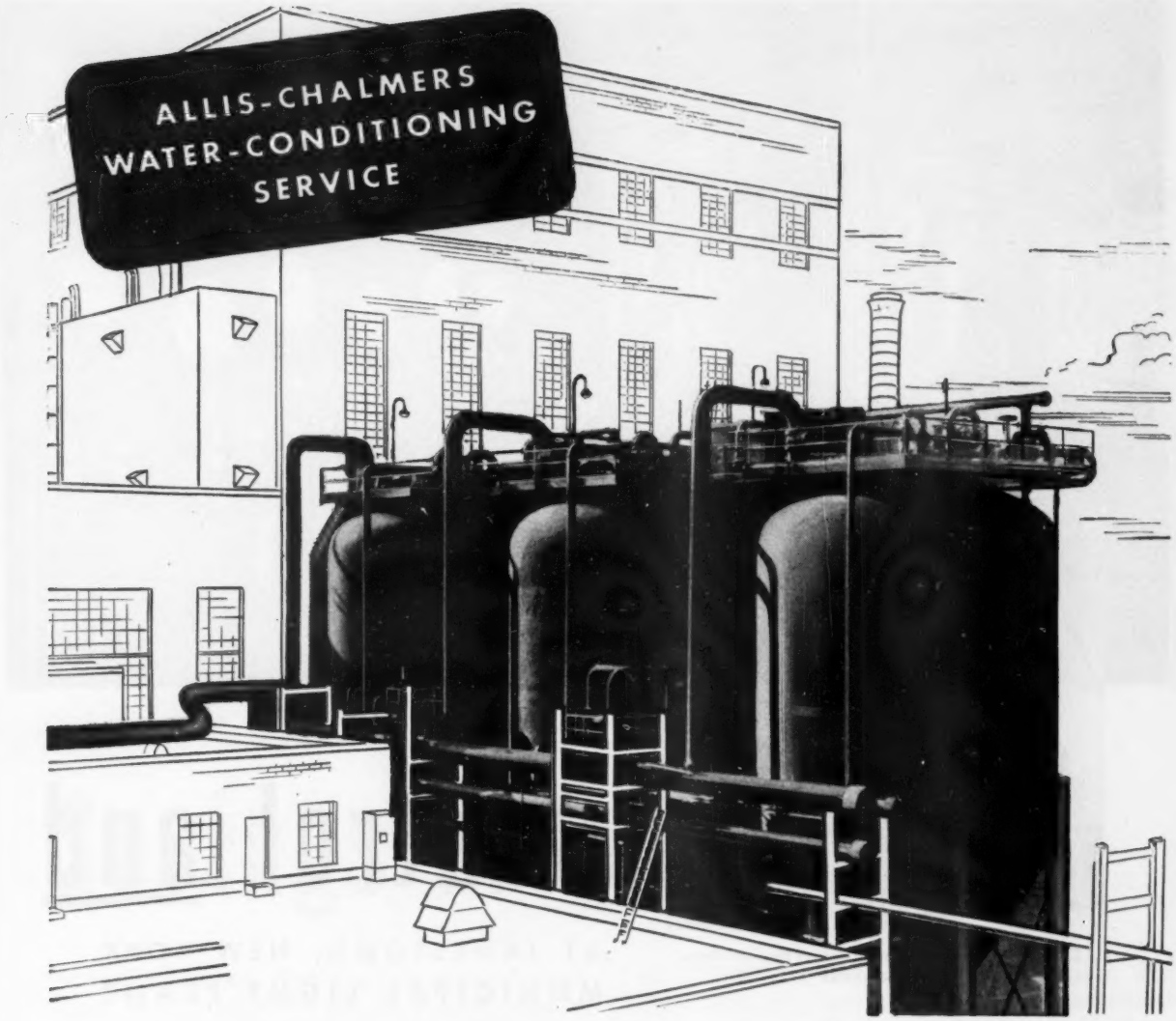
•

Other body and disc materials, as well as linings, available on special order. Also sliding stem valves for automatic operators of all types.

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING



WATER HARDNESS CUT TO ZERO

at record rate of 240,000 gallons per hour!

THIS king-size, outdoor water-softening system was recently installed by Allis-Chalmers to meet the special needs of a leading midwest oil refinery. It furnishes four high-pressure boilers with filtered treated water at the extraordinary rate of 240,000 gallons per hour — the largest water-softening system ever installed in a refinery power plant.

Extremely rugged and designed for year-round operation outdoors, this Allis-Chalmers system has been in service about four years. There have been no breakdowns, and maintenance costs have been practically nil.

Whatever *your* industry—paper, petroleum, food, steel—you'll get prompt, convincing results with Allis-Chalmers Water Conditioning service.

For over 50 years Allis-Chalmers has been building power generation equipment. This experience is invaluable in providing our water conditioning specialists with the extensive background needed today to recommend correct equipment, chemicals and service.

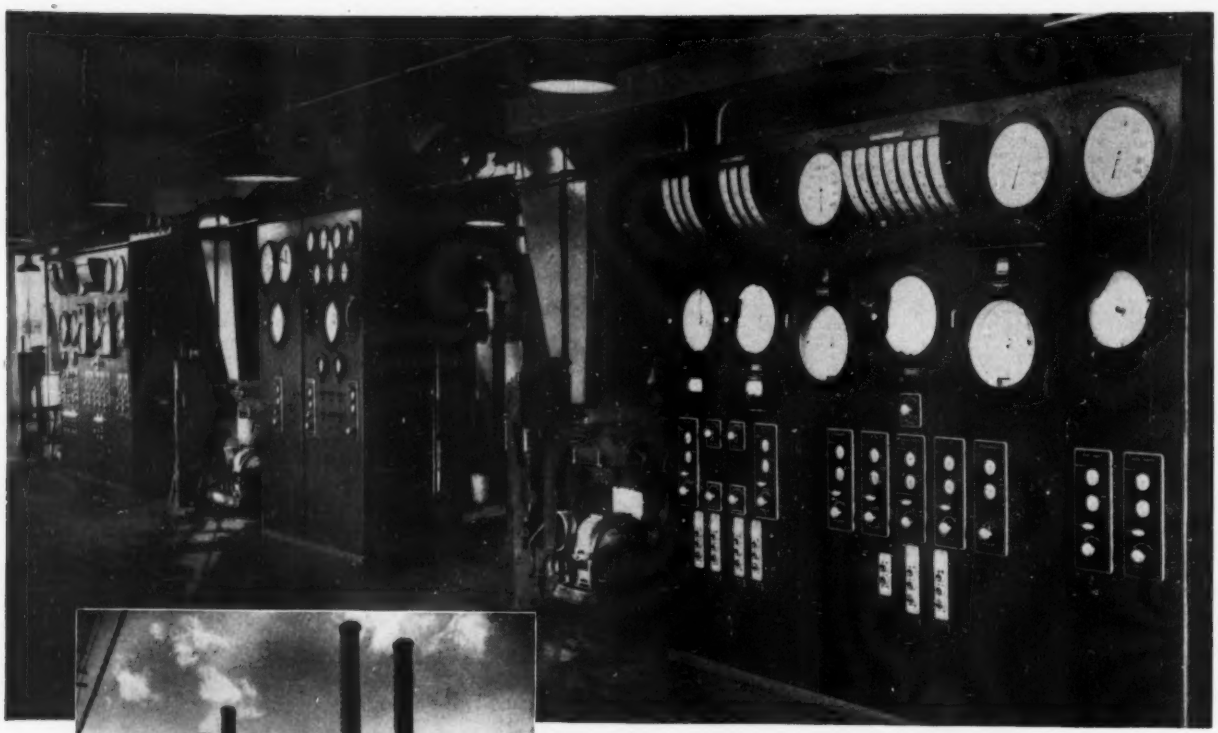
An expert representative is available, ready to recommend proper chemicals or help select the right process for your power plant requirements. For complete information, contact your nearby Allis-Chalmers District Office, or write Allis-Chalmers, Milwaukee 1, Wis.

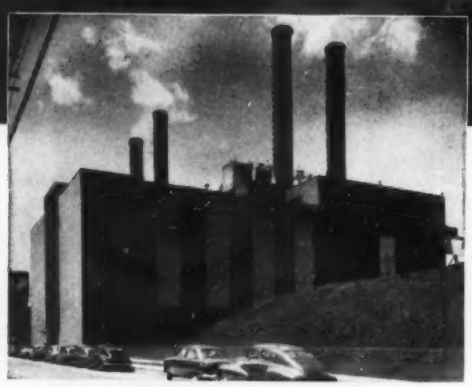
A-3916

ALLIS-CHALMERS

GENERAL MACHINERY DIVISION

MILWAUKEE, WIS. — PITTSBURGH, PA. — NORWOOD, OHIO — BOSTON, MASS. — TERRE HAUTE, IND. — MONTREAL, P. Q. — ST. THOMAS, ONT.





The Jamestown plant is efficient and modern, inside and out.

Control and

AT JAMESTOWN, NEW YORK MUNICIPAL LIGHT PLANT

REPUBLIC Automatic Combustion Controls Operate Boilers at Test Efficiency to:

SAVE FUEL **by maintaining maximum combustion efficiency continuously.**

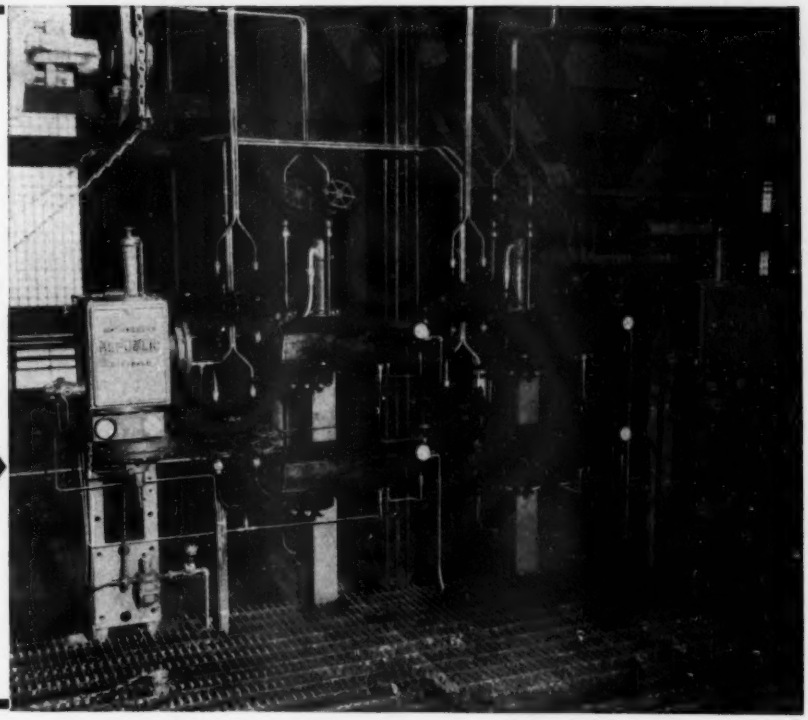
SAVE MAINTENANCE AND EQUIPMENT **by holding uniform operating conditions. Chain-of-event type of trouble that frequently develops as a result of incorrect boiler operation is prevented.**

SAVE MANPOWER **by automatically performing many repetitive adjustments.**

HIGHLY IMPORTANT **during this critical power shortage, the Jamestown plant meets peak load demands because, with REPUBLIC Combustion Controls, it gets all of the steam output the plant boilers are rated for.**

These panels are part of the REPUBLIC Automatic Control System that is used exclusively in the Jamestown plant. When desired, manual operation of the entire boiler system can be made from this location. Panel in the center houses master gauges and other coordinating equipment while panels on either side contain gauges, meters and controls for boilers. REPUBLIC Positioners at left of each panel vary rate of coal feed to pulverizers.

REPUBLIC Regulators and Flow Transmitters are used in the two-element feedwater control system. Rate of feedwater flow to the boiler is changed immediately with a change of either steam flow or feedwater drum level.



Savings are Automatic

At the Jamestown, New York, Municipal Light Plant, two 150,000 lb. per hr. boilers rated at 900 psig. and 900° F.T.T. supply steam to a 20,000 kw turbine. Steam at 275 psig. and 600° F.T.T. is also supplied through a pressure reducing and desuperheater station to an adjoining older plant.

For maximum efficiency and performance, the entire plant is under automatic control. Steam pressure at the turbine is maintained constant and combustion is held at maximum efficiency for steam loads varying from 40,000 lb. per hr. to 165,000 lb. per hr. Both the Automatic Combustion Control System and the pressure reducing and desuperheater station were furnished by REPUBLIC FLOW METERS CO.

ONE OF MANY

This is but one of many power plants that rely on REPUBLIC Instruments and Controls. For more than 37 years, REPUBLIC has specialized in the design and manufacture of automatic control systems for all sizes of power generating stations. REPUBLIC Controls are available for all types of boilers and auxiliary equipment, all kinds of fuel firing (both for single or multiple fuels) and for all load fluctuations. When you specify REPUBLIC Controls, you get the benefit of this complete line of equipment and the services of an experienced engineering staff who know how to put that equipment to use to give you the control system that best meets your requirements.

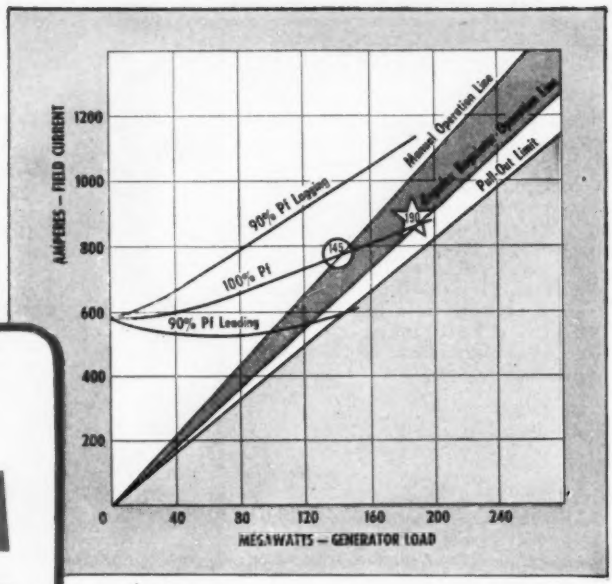
For complete information about REPUBLIC Automatic Control Systems, send for Data Book S-21 or contact our field engineer nearest you. There's no cost or obligation.

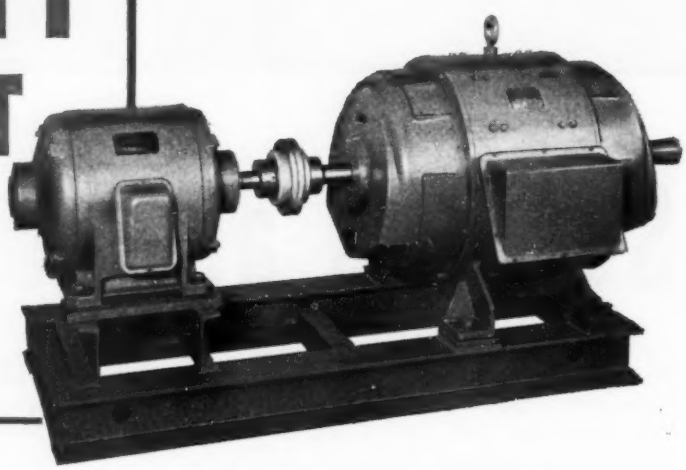
REPUBLIC FLOW METERS CO. ● 2240 DIVERSEY PARKWAY • CHICAGO 47, ILLINOIS

ALLIS-CHALMERS
REGULEX
Voltage Regulator

AFFORDS MAXIMUM KILOWATT OUTPUT

. . . at ANY Power Factor Loading





Automatic minimum excitation provided by *Regulex* voltage regulator permits generator operation closer to the stability limit . . . much closer than manual operation permits. Thus, maximum generator pay load is assured at any power factor loading.

The Graph Tells The Story

By providing maximum stability, *Regulex* voltage regulation establishes and maintains a *safe* ratio between generator load and field current. In the graph, the gray area represents the increase in safe operating limit. The starred figure on the *Regulex* regulator operation line and the circled figure on the manual line afford a comparison of megawatt output. Note that regardless of the power factor loading, a much greater generator pay load is provided by *Regulex* regulator automatic minimum excitation.

Profit in increased kilowatt output . . . meet new demands on old generators . . . get maximum productivity out of new generator installation . . . with the *Regulex* voltage regulator. For complete information, call your A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-3924

Regulex is an Allis-Chalmers trademark.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

SUPERIOR HEAT EXCHANGERS

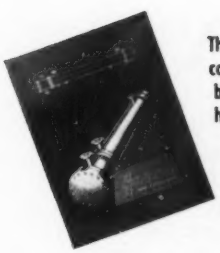
fill the specification for the unusual, as often as for the more conventional.

Salt water can be quite a problem . . . as a coolant used in a heat exchanger. And when it's combined with raw sewage, salt water is just plain rough on some metals.

That particular problem was answered for a major copper producer by SUPERIOR Heat Exchangers with special alloy cupro-nickel linings to retard the corrosive action of the coolant.

SUPERIOR Heat Exchangers are backed by both plant facilities and manpower with the required qualifications to design, fabricate, and guarantee performance *at design ratings* for unusual, as well as for conventional applications.

Our Engineering Staff invites your inquiry regarding any proposed application . . . as a basis for a specific engineering recommendation.



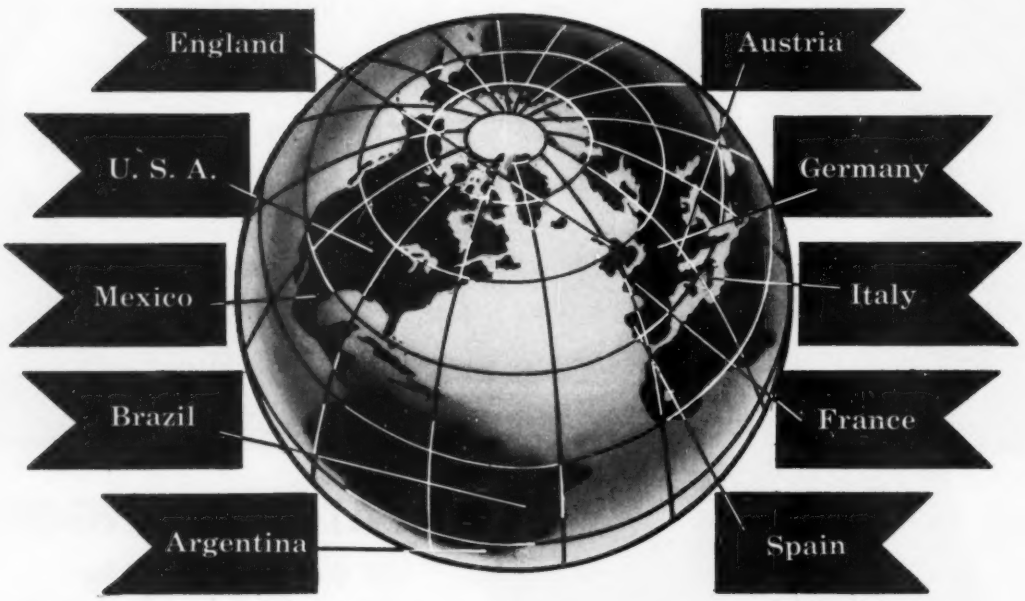
This eight page, two-color catalog describes basic design features of heads, shells, and tube bundles. Write today for catalog No. 501.

for performance you can **BANK** *on*

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

SUPERIOR HEAT EXCHANGERS

WORTHINGTON products manufactured in these countries...



...can be bought in the CORRESPONDING LOCAL CURRENCY

In the countries shown on that globe, Worthington plants manufacture many hundreds of Worthington products. This means that you can obtain Worthington-engineered equipment built to Worthington-U.S.A. standards in the local currency of any one of these countries. Write for complete information on Worthington facilities around the world. Ask for Bulletin WP-1099-B54, Worthington Corporation, Export Department, Harrison, N. J., U.S.A.

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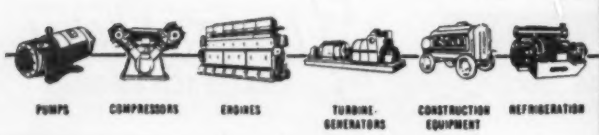
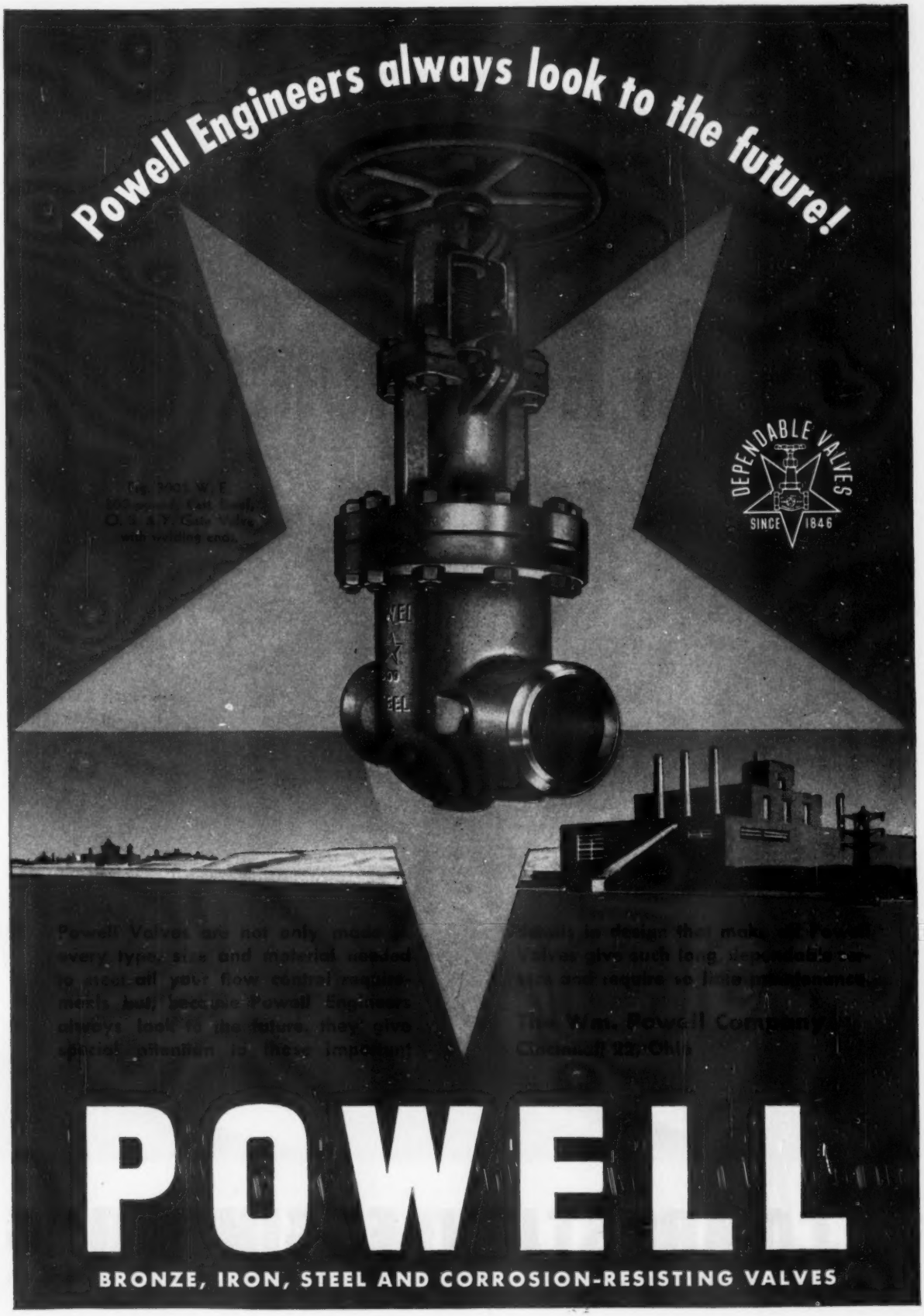


WORTHINGTON

The Sign of Value Around the World

Powell Engineers always look to the future!



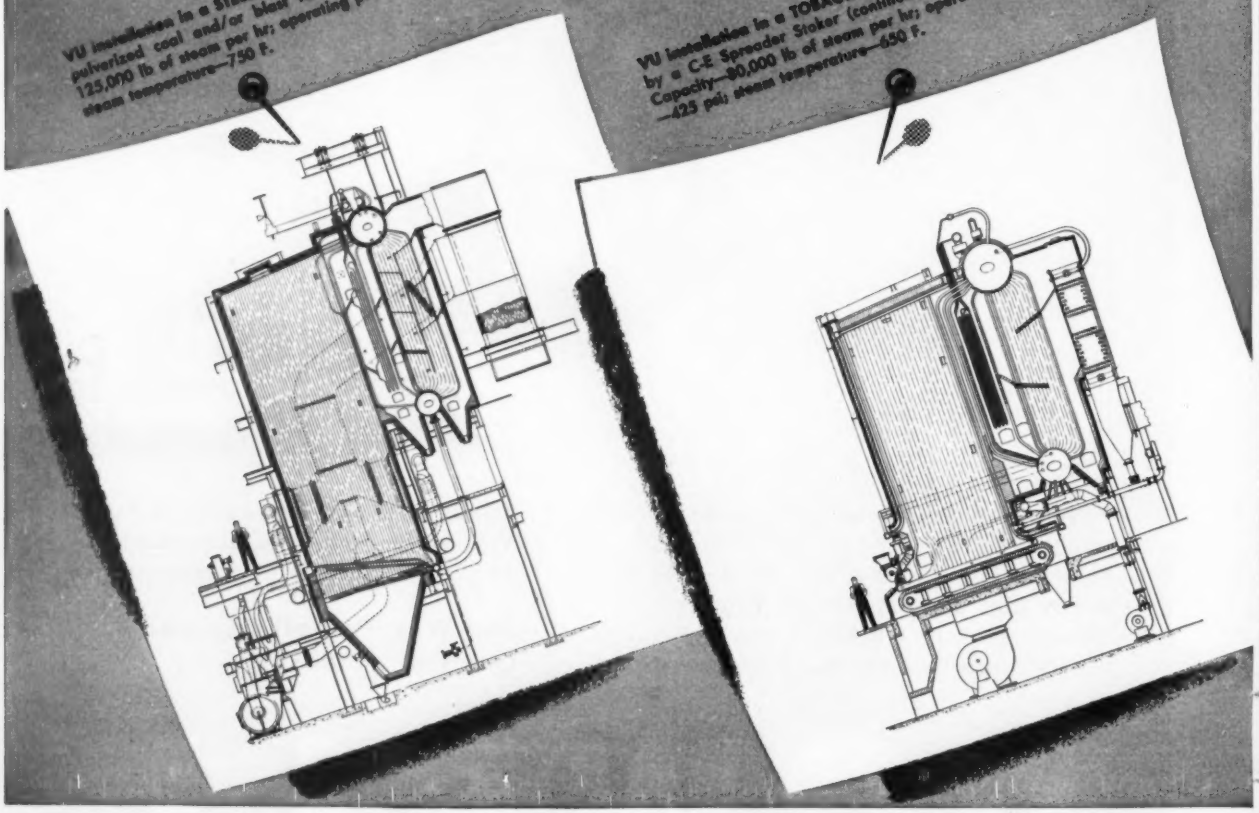
POWELL

BRONZE, IRON, STEEL AND CORROSION-RESISTING VALVES

How different are your Steam Requirements?

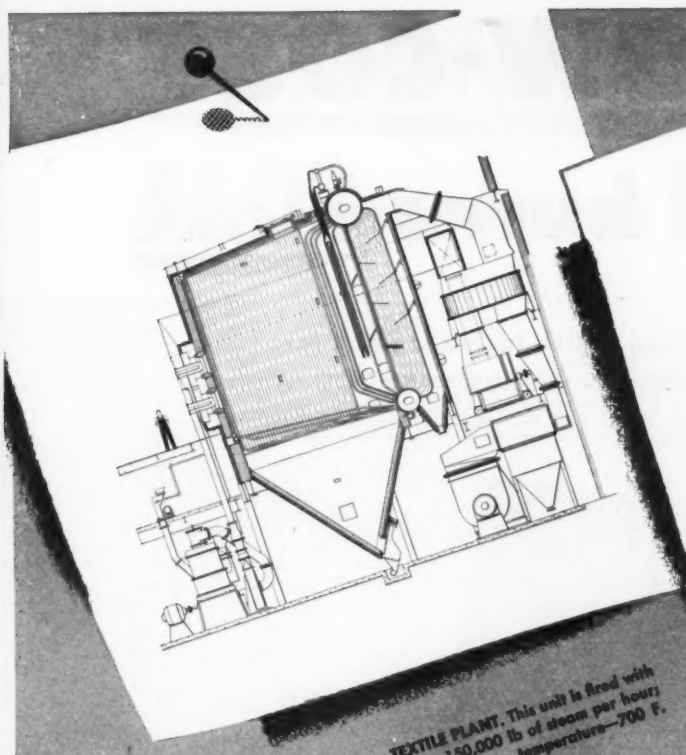
VU installation in a STEEL PLANT. This unit is fired with pulverized coal and/or blast furnace gas. Capacity—125,000 lb of steam per hr; operating pressure—850 psi; steam temperature—750 F.

VU installation in a TOBACCO PLANT. This unit is fired by a C-E Spreader Stoker (continuous discharge type). Capacity—80,000 lb of steam per hr; operating pressure —425 psi; steam temperature—650 F.

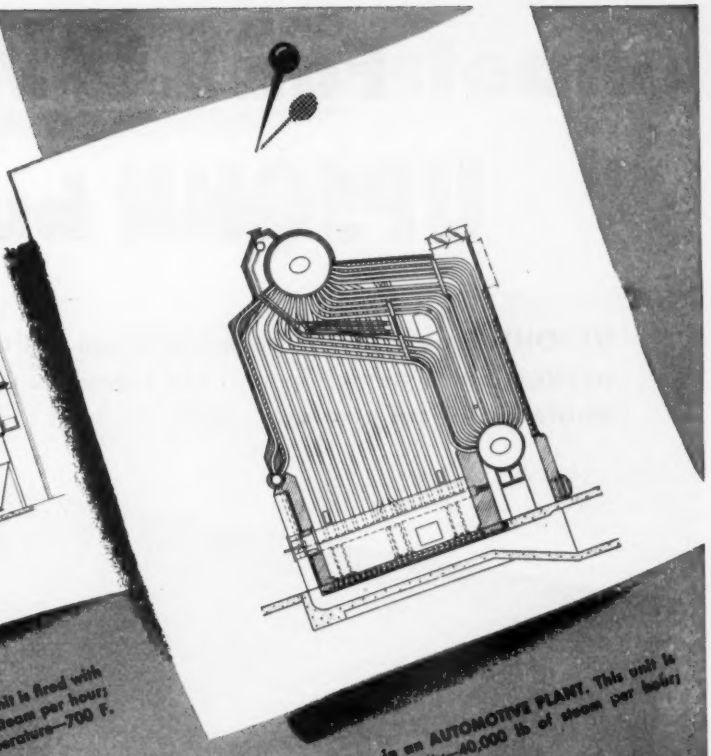


COMBUSTION ENGINEERING

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS



VU installation in a **TEXTILE PLANT**. This unit is fired with pulverized coal. Capacity—150,000 lb of steam per hour; operating pressure—600 psi; steam temperature—700 F.



VU installation is an **AUTOMOTIVE PLANT**. This unit is fired with oil. Capacity—40,000 lb of steam per hour; operating pressure—150 psi.

Every engineer knows that steam requirements vary from industry to industry . . . from plant to plant. It is virtually certain, therefore, that your particular conditions of fuel, load, capacity, pressure and temperature are not exactly the same as those of any other plant.

Yet the C-E Vertical-Unit Boiler can deliver top performance in your plant . . . just as it has done in hundreds of others . . . representing a wide variety of steam conditions.

This is because the basic design of the VU allows exceptional latitude in the selection of the *right* boiler to fit your particular requirements. It is available in capacities from 10,000 to 350,000 lb of steam per hr, with pressures from 160 to 1000 psi and temperatures up to 900 F, or more. It is adaptable to limited space conditions and to the use of any fuel or method of firing. The VU may be operated over a wide range of output, and, depending on fuels and the use of heat recovery equipment, efficiencies range up to 88%.

How well is the Vertical-Unit Boiler meeting the steam requirements of different industries? The answer is to be found in an impressive record of orders and repeat orders covering virtually every field. If you would like first hand information on the story of the VU Unit in *your* industry we would be glad to send it to you.

* * *

The point is that the story is the same . . . in industry after industry . . . *the popularity of the C-E Vertical Unit Boiler is widespread and steadily increasing.* Why not investigate how the variables of your requirements can be matched with the VU Unit for top performance?

B-340

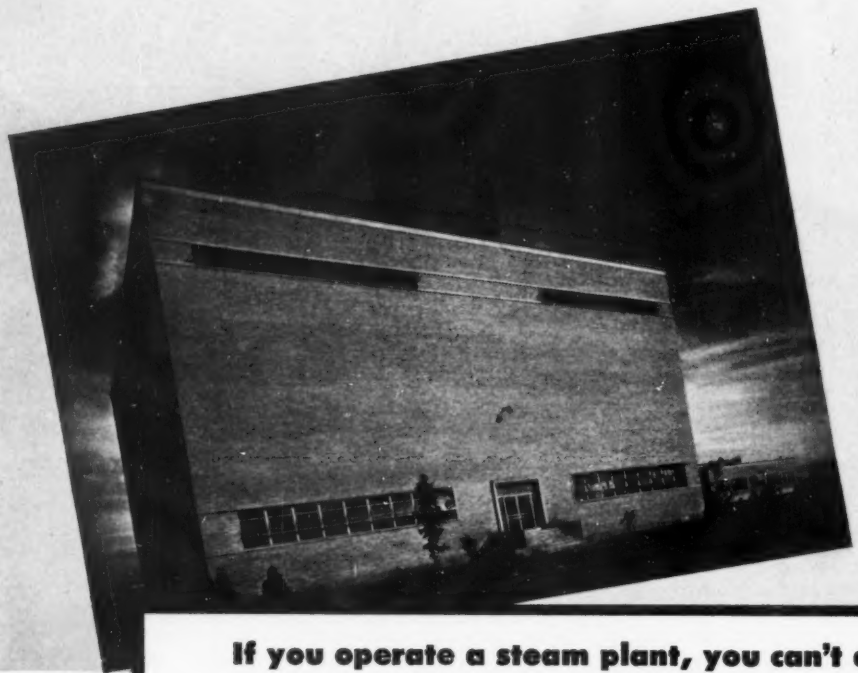
— SUPERHEATER, INC.

200 MADISON AVENUE, NEW YORK 16, N. Y.

C-E

For LOW-COST UPJOHN burns COAL

UPJOHN'S new pharmaceutical plant which includes units for production of penicillin and cortisone, as well as some 700 other pharmaceutical products, relies on coal for dependable steam.



This ultramodern boiler house supplies steam, cleanly and efficiently, at only 40¢ to 42¢ per 1,000 lbs. It delivers 115,000 lbs. per hour at peak load for the Portage Road Plant near Kalamazoo, Michigan.

There are no dust or smoke nuisances, thanks to the dust collecting and cinder re-injection system.

For both efficiency of operation and economy, you just can't beat coal burned the modern way!

If you operate a steam plant, you can't afford to ignore these facts!

COAL in most places is today's lowest-cost fuel.

COAL resources in America are adequate for all needs—*for hundreds of years to come.*

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

FOR HIGH EFFICIENCY
FOR LOW COST

DEPENDABLE steam, the modern way!

CLEAN, CONVENIENT!

This view of Upjohn's firing aisle shows how clean and convenient coal can be when handled and burned the modern way. The stoker hoppers are fed from an overhead bunker. A 2-ton capacity weigh larry serves all boilers.

The ash handling is fully automatic. Traveling grates continually discharge ashes into hoppers below the floor of the firing aisle.

The 3 boilers shown, plus a fourth recently installed (not illustrated), supply all Upjohn's steam needs.

• Whether you're building a new plant or modernizing an older one, you can count on coal for dependability and low-cost operation.

Here's why: Up-to-date coal-burning equipment can give you 10% to 40% more steam per dollar. Automatic coal- and ash-handling systems can cut your labor cost to a minimum. Let a consulting engineer show you how a modern coal installation, tailored for your specific needs, can save you real money.

Here's something else, too—of all fuels, coal alone has virtually inexhaustible resources. This, plus the fact that America's coal industry is the most efficient in the world, assures you of a dependable supply of coal at relatively stable prices now and for years to come.

BITUMINOUS COAL INSTITUTE
A Department of National Coal Association
WASHINGTON, D. C.

YOU CAN COUNT ON COAL!

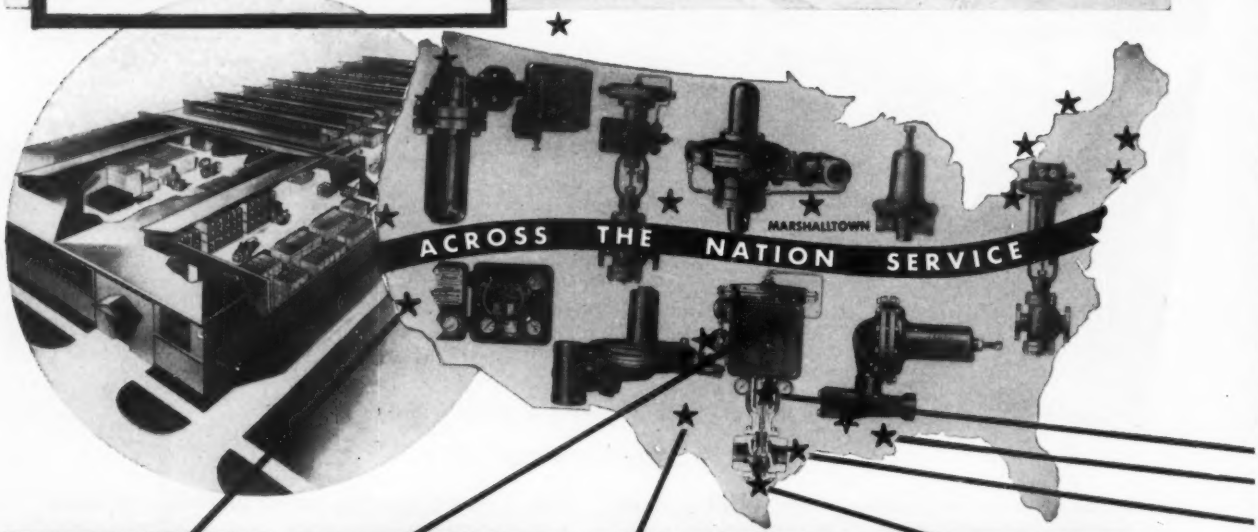
FISHER®

FACTORIES...AND FIELD STOCKS

MARSHALLTOWN, IOWA

• *Above*—**Factory No. 1.** Over 220,000 sq. ft. of floor space. The industry's most modern plant. Here the world's largest production of pressure and liquid level control equipment is made possible by Fisher's unequalled research, design, engineering, testing and manufacturing facilities.

• *Below*—**Factory No. 2.** Over 50,000 sq. ft. of floor space. A major unit in Fisher's continuing expansion program of increased facilities and production.



FISHER PRESSURE REGULATORS · GAS REGULATORS
LIQUID LEVEL CONTROLLERS

ASSURE YOU DELIVERY

Where you want it!

When you want it!

You are *always* close to a source of supply of Fisher *control valves, gas regulators, liquid level controllers* and *pressure regulators.*

Whether your problem is one of existing equipment—or an entirely new control application—the Fisher country-wide network of *19 strategically located field stocks* and *51 representatives*—with over *200 Fisher Service Engineers*—offers you *immediate* and *convenient* service on all your control requirements.

A few typical Fisher Warehouse Stocks of new equipment and replacement parts are shown below.

FISHER GOVERNOR COMPANY • MARSHALLTOWN, IOWA

WORLD LEADER IN RESEARCH FOR BETTER PRESSURE AND LIQUID LEVEL CONTROL

DIAPHRAGM CONTROL VALVES • PUMP GOVERNORS
LEVER AND FLOAT VALVES

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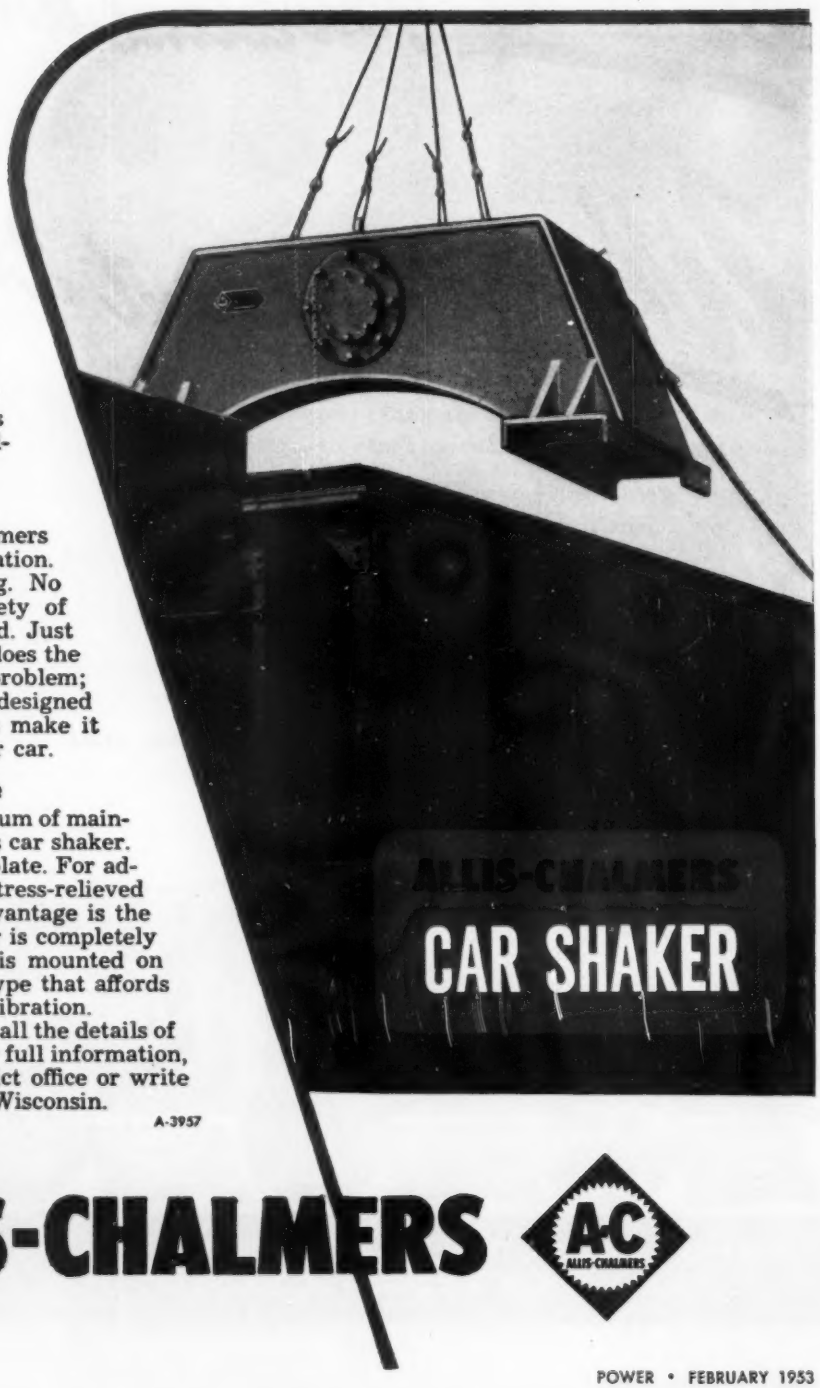
CUT UNLOADING COSTS



You can save time and money using Allis-Chalmers car shakers for unloading cars. Here are two examples: **(1)** You can unload cars of wet sand or like materials in 1½ to 2¼ minutes; **(2)** you can unload coal in 1 to 6 minutes, depending on surface moisture.

In fact, you can unload any material in minutes, even if it is damp, compacted or in a partially frozen condition.

One-Man Operation

Best of all, using an Allis-Chalmers car shaker is a one-man operation. No more pounding or digging. No more worrying about the safety of men inside cars being unloaded. Just press a button; the car shaker does the rest. There is no positioning problem; Allis-Chalmers car shakers are designed to hang level, and wide shoes make it easy to engage any size hopper car.

Low Maintenance

You'll get long life and a minimum of maintenance with an Allis-Chalmers car shaker. Sides and top are heavy steel plate. For additional strength, the body is stress-relieved after welding. Another big advantage is the power arrangement. The motor is completely enclosed in the body. And it is mounted on rubber shear mountings of a type that affords maximum protection against vibration.

It will pay you to investigate all the details of Allis-Chalmers car shakers. For full information, consult your nearby A-C district office or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3957

ALLIS-CHALMERS

View, showing 16 cells of new Foster Wheeler cooling tower erected on foundation of old tower. Portion of old tower, shown at right, was replaced by 8 cells of new tower.

Tailored to fit customer plant conditions!

THE ERECTION of this new 24-cell cooling tower on the same foundation as the 56-cell tower which required replacement, without interruption in cooling capacity, is another example of the ability of Foster Wheeler to tailor the job to conditions in the customer's plant.

To assure a continuous supply of cooling water while the new tower was being built, 30 cells of the old tower were razed and the remaining 26 cells connected to two smaller existing towers by a temporary flume. The first 16 cells of the new tower were then erected and put into operation in time to meet the oncoming summer heat load. The remainder of the old tower was then removed and the balance of eight new cells erected.

It is through such unusual types of installations that Foster Wheeler has gained the reputation for engineering and construction excellence.

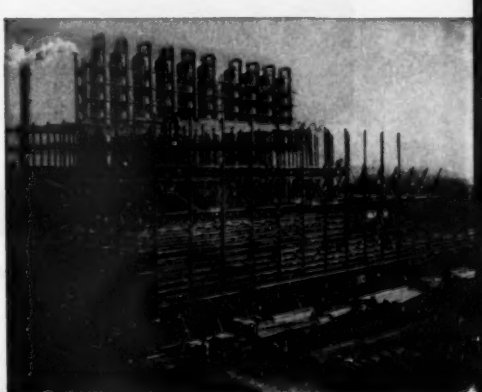
FEATURES OF THIS INSTALLATION:

Combination cast iron and red brass distribution system, with 720 special full coverage red brass up-spray nozzles, provides uniform water distribution over a wide variation in water flow rates. Induced-draft fans with 16-foot stacks discharge tower vapors at a high velocity 60 ft. above basin curb—reducing recirculation to a minimum.

The new tower requires 4320 sq. ft. less ground area than the old tower—enough to allow for the addition of four 30 ft. by 36 ft. cells for future requirements.

DESIGN CONDITIONS

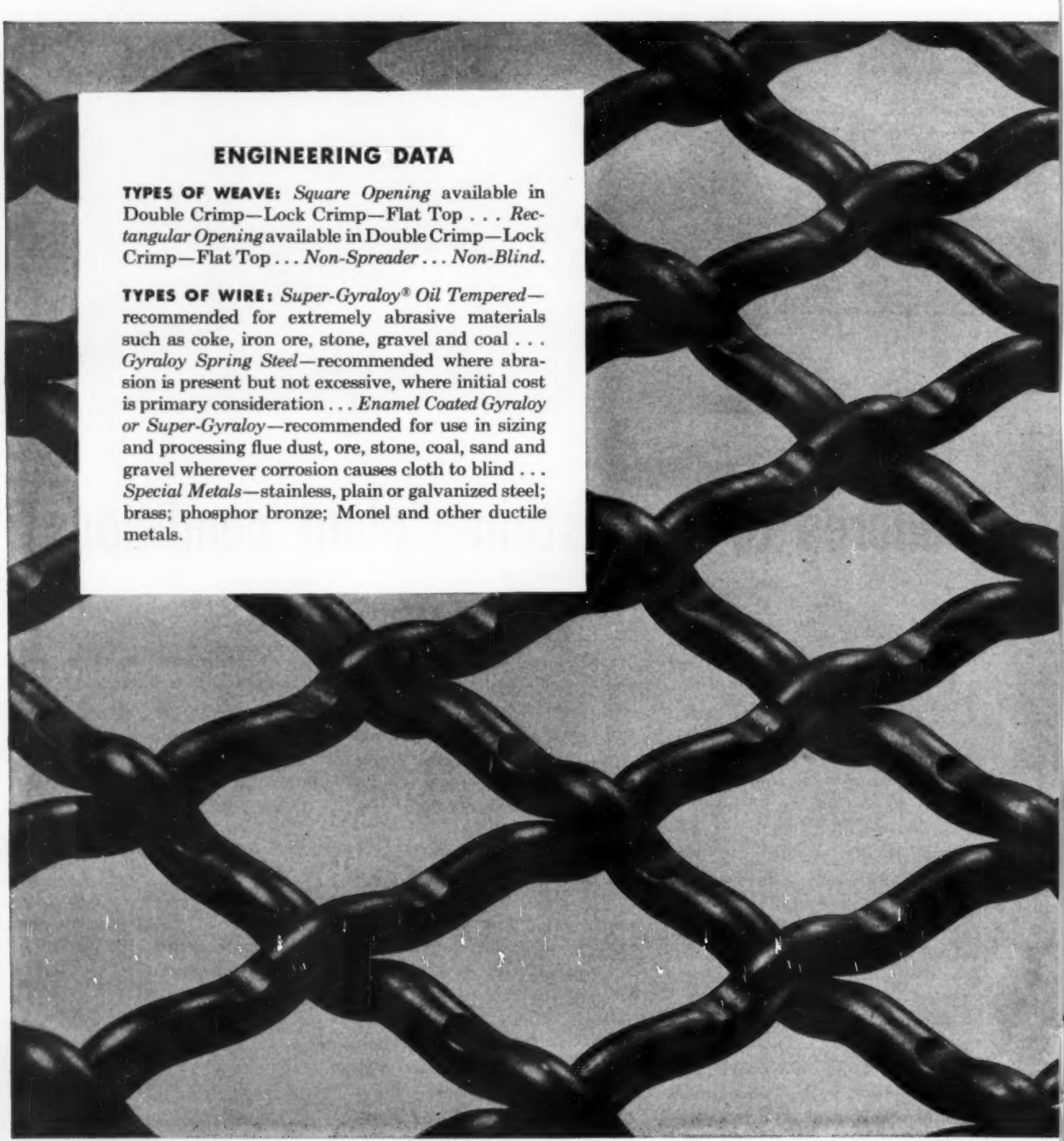
Capacity	48,000 U.S. gpm
Inlet water temperature	120° F
Outlet water temperature	85° F
Wet bulb temperature	80° F



FOSTER WHEELER CORPORATION, 165 BROADWAY, NEW YORK 6, NEW YORK

FOSTER WHEELER

We'll Give You Better



ENGINEERING DATA

TYPES OF WEAVE: *Square Opening* available in Double Crimp—Lock Crimp—Flat Top . . . *Rectangular Opening* available in Double Crimp—Lock Crimp—Flat Top . . . *Non-Spreader* . . . *Non-Blind.*

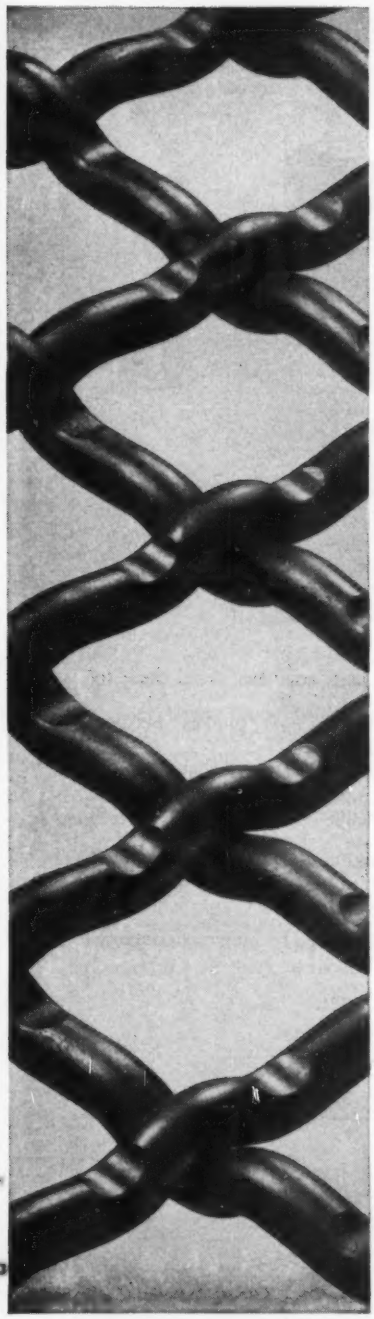
TYPES OF WIRE: *Super-Gyraloy® Oil Tempered*—recommended for extremely abrasive materials such as coke, iron ore, stone, gravel and coal . . . *Gyraloy Spring Steel*—recommended where abrasion is present but not excessive, where initial cost is primary consideration . . . *Enamel Coated Gyraloy or Super-Gyraloy*—recommended for use in sizing and processing flue dust, ore, stone, coal, sand and gravel wherever corrosion causes cloth to blind . . . *Special Metals*—stainless, plain or galvanized steel; brass; phosphor bronze; Monel and other ductile metals.

HEWITT-ROBINS INCORPORATED

HEWITT-ROBINS

DIVISIONS: HEWITT RUBBER • ROBINS CONVEYORS • ROBINS ENGINEERS • RESTFOAM®

Screen Cloth Delivery



Increased Production Capacity Assures Faster Delivery For All Types Of Hewitt-Robins Screen Cloth

Now, we can give you faster delivery—*direct from our own modern plant*—of the finest quality screen cloth to meet your every need . . . Screen Cloth that gives you longer life, greater satisfaction on any type of screen, regardless of make . . . Screen Cloth that will provide you with highest efficiency, lowest cost per ton.

For shorter delivery on any type of Hewitt-Robins screen cloth send us this information:

1. Type of screen—Name of manufacturer—Model of machine.

2. Kind of screen cloth desired: Specify type *weave*—type of *wire*.

3. Size of clear opening or mesh and wire diameter.

4. Type of edge formation: Flat edges — Welded — Reinforced hook strips.

5. Length and width of panels (width measured from outside to outside of bent hooks)—Height and length of hook strips—Degree of angle inside of hook.

6. For rectangular, non-spreader or non-blind openings: Specify direction of long slot (which dimension of cloth it parallels).

7. For dewatering decks: Size of openings in mm—Single, double or no depressions—Round or triangular profile stainless steel rods.

WRITE FOR SCREEN CLOTH BULLETIN No. 113-A1

CHECK FOR INFORMATION ABOUT THESE JOB-TESTED PRODUCTS FOR YOUR OPERATION

CONVEYORS:
- ☐ —Belt
- ☐ —Dock
- ☐ —Vibrating

BELTING:
- *☐ —Elevator
- *☐ —General
- *☐ —Rayon
- ☐ —Woven Wire

☐ **BUCKET ELEVATORS**

☐ **IDLERS**

SCREEN CLOTH:
- ☐ —Electrically Heated
- ☐ —General

☐ **VIBRATING SCREENS**

HOSE:
- *☐ —Air
- *☐ —Fire
- *☐ —Flexible Rubber Pipe
- *☐ —Pinch Valve
- *☐ —Servall®
- *☐ —Steam
- *☐ —Twin-Weld®
- *☐ —Water

☐ **MECHANICAL FEEDERS**

☐ **STACKERS**

☐ **CAR SHAKEOUTS**

TRIPPERS:
- ☐ —General
- ☐ —Dust Seal

☐ **BELT CLEANERS**

☐ **CRUSHERS**

☐ **STOCKING & RECLAIMING SYSTEMS**

☐ **DESIGN AND CONSTRUCTION OF COMPLETE MATERIALS HANDLING SYSTEMS**

*For immediate information about these industrial rubber products, call your Hewitt Rubber Distributor (See "Rubber Products" Classified Phone Book).

Hewitt-Robins Incorporated
666 Glenbrook Road
Stamford, Connecticut

NAME _____

TITLE & COMPANY _____

STREET ADDRESS _____

CITY _____ PO ZONE _____ STATE _____

INCORPORATED

EXECUTIVE OFFICES: STAMFORD, CONNECTICUT

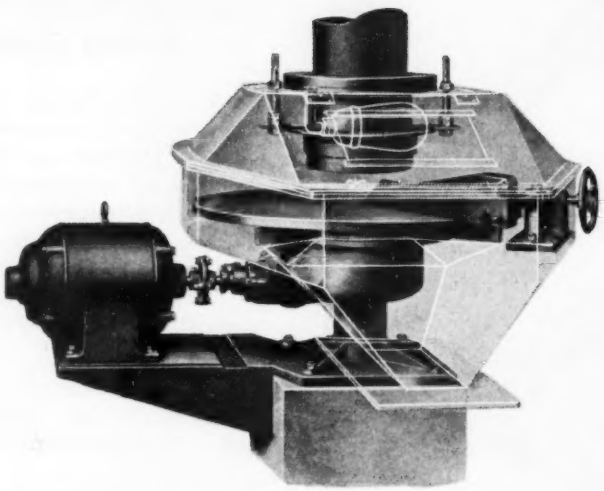
Firing Systems CUT FUEL COSTS TO THE BONE!

A FEEDER THAT HAS NO EQUAL FOR EFFICIENCY AND RELIABILITY

● The KVS enclosed Disc Feeder offers many advanced features which contribute to efficiency and ease of operation. For example:

Feeder is internally illuminated with a glass door in housing for visual indication of the moving coal. Electric motor drives rotating disc through worm gear, enclosed in oil and dust tight housing.

Telescopic sleeve installed on the down spout from coal bunker terminates above feeder disc, the coal forming a cone between sleeve and disc. An adjustable knife or plow cuts into the coal cone and spills it over the edge of disc into feed chute of pulverizer. Continuous operation of feeder not affected by tramp iron or other foreign substance.



KVS Enclosed Disc Feeder prevents coal dust from escaping into boiler room. Designed to prevent coal "chokes" between bunker and feeder chute. Rate of feed varied by changing position of knife which cuts into coal cone or by changing speed of disc by means of adjustable speed control of the drive motor.

Volumetric type; accuracy not disturbed by moisture contained in coal.

IT COSTS LESS.. TO OWN THE BEST!

KENNEDY - VAN SAUN
MANUFACTURING & ENGINEERING CORPORATION
TWO PARK AVENUE, NEW YORK
***FACTORY* DANVILLE, PA.**

KENNEDY Pulverized Coal

KVS Air Swept Tube Mill is designed to provide extremely fine pulverization of any grade of coal. Worm drive, mounted in roller bearings with gear and worm direct-connected to shaft. Produces a fineness of 90% to 95% through U. S. standard 200 mesh screen. Up to 20% moisture removed during pulverizing operation. Ferris wheel type lubricating system with oil reservoir in base of bearing. Anti-friction bearings on gear shaft lubricated by oil splash.

INSTANT RESPONSE TO ALL COMBUSTION REQUIREMENTS

● KVS Air Swept Tube Mills assure complete and rapid combustion through extremely fine pulverization of any grade or quality of coal... wet or dry... regardless of grindability.

All the heat value of coal can be utilized at lower cost with the KVS method than by any other coal pulverizing equipment. YOU CAN SAVE UP TO A DOLLAR PER TON ON EVERY TON OF COAL YOU BURN!

Such important savings will more than pay for the equipment in a very short time and continue to pay dividends for years to come.

KVS offers engineering service in the design, building and erection of complete steam power plants for firing lowest grade fuel, screening, tailings etc. or for any solid or liquid that will burn. Get particulars of this service *before* you specify.

KENNEDY

Pulverized Coal Firing Installations are in use in leading plants throughout the world.

Let our engineering department furnish complete boiler designs for your steam requirements. Plans and estimates that will reduce your fuel and operating costs.

valve values
PHOTO NEWS

Incubator for Ideas

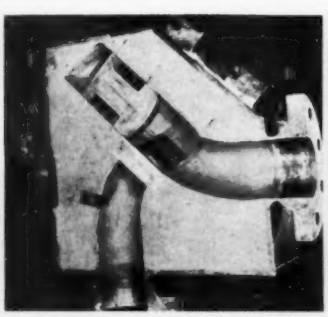
Edward's new Engineering Building, above, symbolizes the pride we take in our engineering staff. To house these men—whom we believe to be the most talented and experienced group of valve engineers to be found anywhere—we've constructed this building specially designed to permit them to operate at their highest possible efficiency. For example, the Engineering Building is immediately adjacent to our laboratories, permitting frequent and immediate consultation between engineers working with specific design problems, and laboratory research scientists.

Together, engineering and research maintain a rigid step-by-step control over all Edward operations. Nowhere is this more evident than in the development of a new valve to meet customer requirement. Let's take a brief look at some of the steps in the production of one of Edward's latest designs.

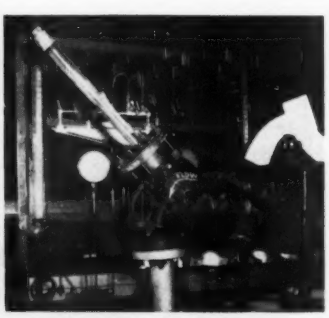
THE PROBLEM: **A prominent boiler manufacturer was designing a new unit to obtain increased efficiency from more rapid circulation of water within the boiler. They proposed to control this circulation by specially designed pumps. Special stop-check valves with absolutely tight shut-off characteristics were required to protect these valuable pumps from back flow of water from the boiler. Because of the low differential pressure in the circuit, pressure drop across the valve had to be kept to an absolute minimum.**

Product development committee first explored the problem thoroughly, then initiated a project . . .

. . . in research laboratory to determine basic fundamentals of design which were finally expressed in . . .



. . . plastic half models which were tested on flow machines. Lessons learned here were incorporated in . . .



. . . ¼ scale steel model given regular operating tests which suggested refinements for . . .

Edward Valves, Inc.

Another Product

. . . final full scale experimental model which was tested on complete flow hookup. Passing with flying colors . . .

. . . the new model went to engineering for final determination of production techniques to be used and. . .

. . . detailed drawings for machinists and inspectors were made for use in actual production . . .

. . . where it was under the constant supervision of inspection services guided by the Engineering Department. Finally we could deliver to the customer . . .

THE SOLUTION: The new stop-check valve pictured above. Developed in 10 in. and larger sizes for boiler pressures from 1500 to 3000 lbs, this new valve easily meets the rigid requirements of perfect shut-off and minimum pressure drop. In addition, the original piping design called for a valve and elbow. A special design was evolved incorporating both of these into the valve, thus eliminating an elbow and weld at a substantial saving to the customer.

EDWARD VALVES, Inc., *Subsidiary of*
ROCKWELL MANUFACTURING COMPANY
1220 W. 144th STREET • EAST CHICAGO, INDIANA

GLOBE AND ANGLE STOP • FEED-LINE • BLOW-OFF • NON-RETURN CHECK • GATE • GAGE AND INSTRUMENT • RELIEF • STRAINERS

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Technical Tips

Closing Torques for Globe Valves Against High Pressures

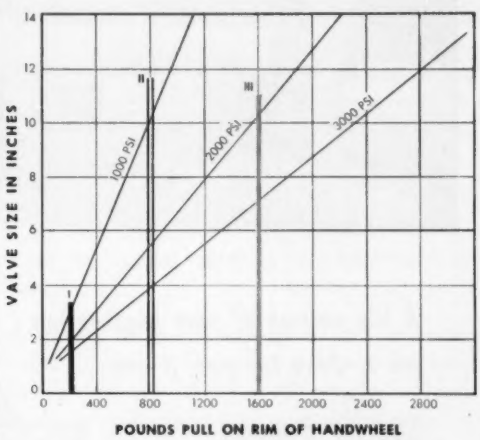
Where tight closure on high pressure lines is absolutely essential, globe valves are usually selected in preference to other valve types.

However, a simple calculation will show that it is almost impossible for one man to close a large globe valve on a high pressure line without some sort of mechanical aid. Edward provides this required mechanical advantage in the simplest, most inexpensive form through the highly effective Impactor handwheel.

In a globe-stop valve, the torque on the handwheel rim must be sufficient to generate a downward force in the valve stem at least equal to the pressure to be held under the valve disk times the area of the disk. This force varies directly with size and operating pressure. Deviations also arise from differences in the trueness of the two mating seating surfaces, packing friction, stem thread friction, and the ratio of stem diameter to handwheel diameter.

The chart below shows the approximate theoretical steady pull required on the rim of a handwheel to create a tight seat in Edward high pressure globe valves with operating pressures of 1,000, 2,000 and 3,000 pounds.

The average man cannot pull more than about 200 pounds on the rim of a handwheel. Therefore, some sort of supplementary closing device is needed for the pressures covered on our chart, in almost the complete range of valve sizes.



POUNDS PULL ON RIM OF HANDWHEEL

I. Limit of closing torque one man can exert by hand.

II. Torque one man exerts with ten blows of 12" Impactor Handwheel.

III. Torque one man exerts with ten blows of 36" Impactor Handwheel.

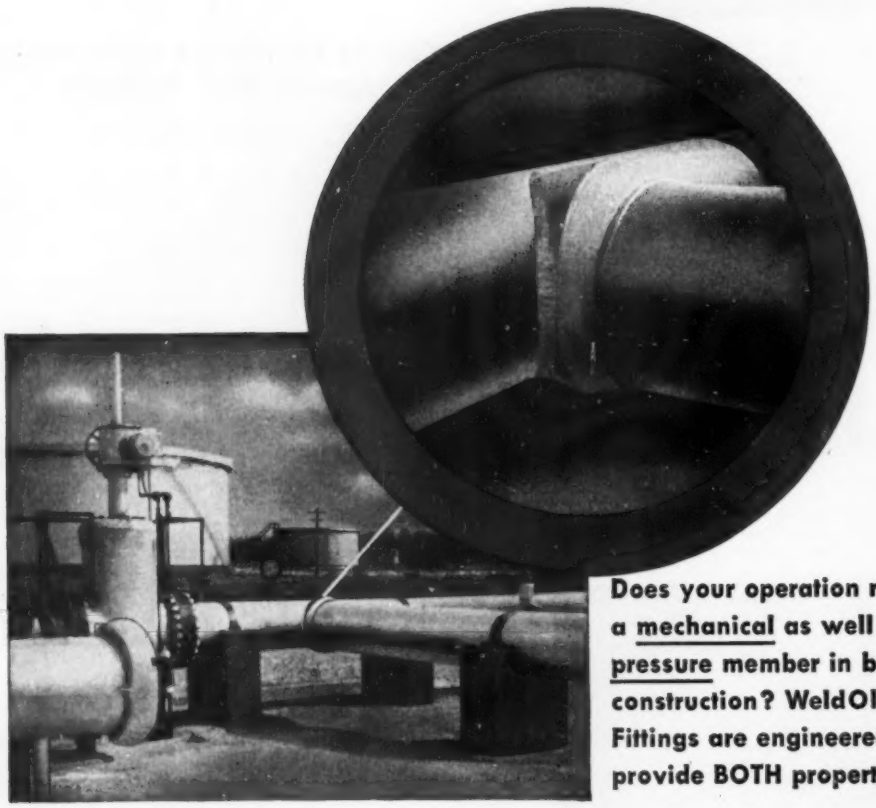
Lines II and III on the chart show the closing effect obtained by one man with two different sizes of Impactor handwheels. Line II shows the closing torque exerted by ten blows of a 12 in. Impactor handwheel, namely, four times the effect which would be obtained by the same man exerting only a steady pull. Line III shows the closing torque exerted by ten blows of a 36 in. diameter handwheel, eight times the unaided closing torque.

For some combinations of higher pressures and larger valve sizes on the chart, ten blows of either handwheel does not indicate complete closure. Additional blows with the Impactor will readily obtain drop tight closure in each case.

Edward

ENGINEERED REINFORCEMENT

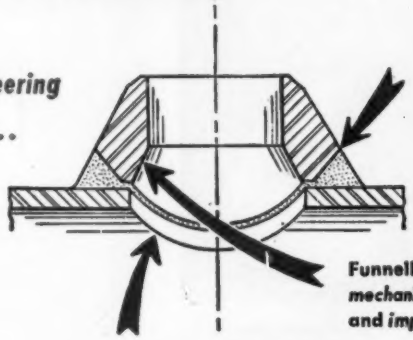
FOR YOUR BRANCH CONNECTIONS



Does your operation require a mechanical as well as a pressure member in branch construction? WeldOlet Welding Fittings are engineered to provide BOTH properties.

A big portion of your engineering job is done for you, if you...

Specify Bonney WeldOlet Welding Fittings to Insure Permanent Strength



Reinforcement where both the mechanical and internal *stresses are most severe*

Funnelled to relieve *mechanical stress concentrations* and *improve fluid flow*

Shaped and beveled for *clean, quick* and *economical installation*

FOR COMPLETE ENGINEERING DATA WRITE FOR YOUR BONNEY W3 WELDOLET CATALOG

WELDING FITTINGS DIVISION

BONNEY FORGE & TOOL WORKS

ENG. DEPT., 350 GREEN STREET

ALLENTOWN, PENNSYLVANIA

PHILIP SWAIN, EDITOR • FEBRUARY 1953 • ESTABLISHED 1882 Power

Battle of the Experts

THIS STORY STARTS with POWER's publication, last March, of certain radically new thermodynamic theories advanced by Neil Bailey, Professor of Mechanical Engineering at Rensselaer Polytechnic Institute, Troy, N. Y. Bailey challenged accepted theories on both theoretical and experimental grounds. He said that their logic is wrong and they do not agree with experiment.

As was to be expected, the POWER article excited wide interest among power engineers, but especially among the professional experts in thermodynamics—those in industry and those in educational institutions.

Since Professor Bailey's paper was admittedly over the heads of most practical power engineers, they stood by to watch the show with little comment. On the other hand, the professional thermodynamicists, almost to a man, were in disagreement with Professor Bailey.

To air the conflicting views, a well-attended forum was held at RPI in April. Professor Bailey again presented his theories, which were, in the main, opposed by the discussers. To sum up without any technicalities, it can be said that this meeting at Troy started and ended in almost complete disagreement between Professor Bailey on the one hand and the body of the profession on the other.

By publishing several discussion letters in August, POWER provided a continuing forum for the debate. Yet, still, there was almost complete disagreement.

Finally came the climax—a paper and discussion at the annual meeting of the ASME on December 3. Several hundred highly interested observers and participants crowded the room. The battle of the thermo experts started at 9 am and terminated (perhaps chiefly from exhaustion and hunger) at 2 pm. Once again it was Professor Bailey against the field. Bailey restated his views and virtually every discusser disagreed.

So there the battle rests today. The editors of POWER, and presumably most power engineers, must leave the final verdict to history.

It is unfortunate that some feelings have been badly bruised in this "operation thermo," yet there is a bright side. The events cited show that it is still possible, at least in America, for a professional man of standing to get a full hearing for radically new concepts. In this case Professor Bailey had *three* platforms. This, too, is significant.

Some have suggested that the first announcement of new theories should never be made except through the professional society of the specialty under discussion. Rigid application of any such policy would, we feel, be most unfortunate—a dangerous step away from freedom of expression in this country. If the time ever comes when scientific expression must proceed through a single channel, those who control that channel will have the power of death over new ideas. That must never happen here.

"Experience showed us how FUSETRON FUSES Prevent Motor Burnouts . . . now we protect all Motors on our Units with them!"

Franklin Van Reed
Production Engineering Supervisor
ORR & SEMBOWER, INC., Reading, Penn.

"Here's what Happened in our Plant"

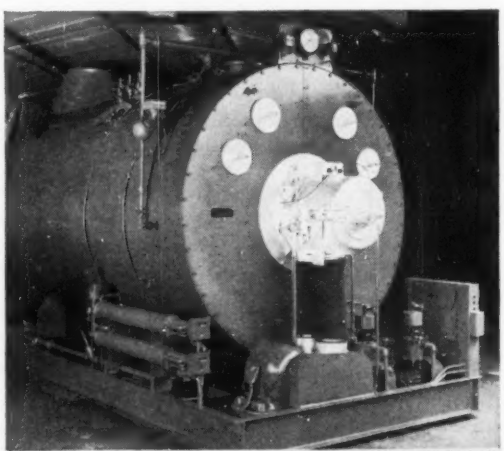
Back in January of 1951 we had a motor on a pump that was supposed to draw a maximum load of about 8 amperes, yet it began blowing FUSETRON fuses of motor protection size.

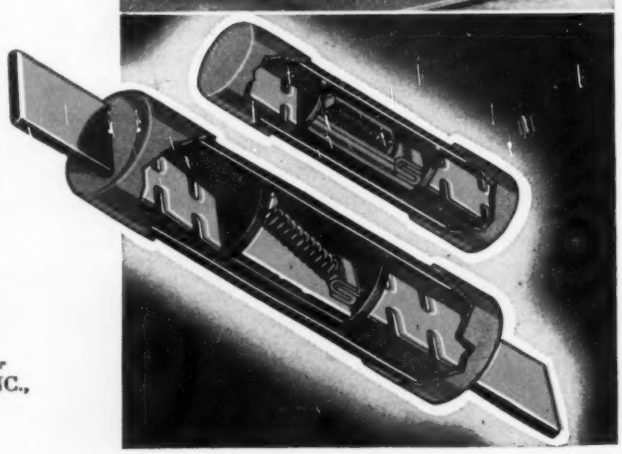
"We were inclined to believe something was wrong with the fuses — but after checking with an ammeter we found that an automatic relief by-pass was sticking and causing the motor to draw about 12 amperes.

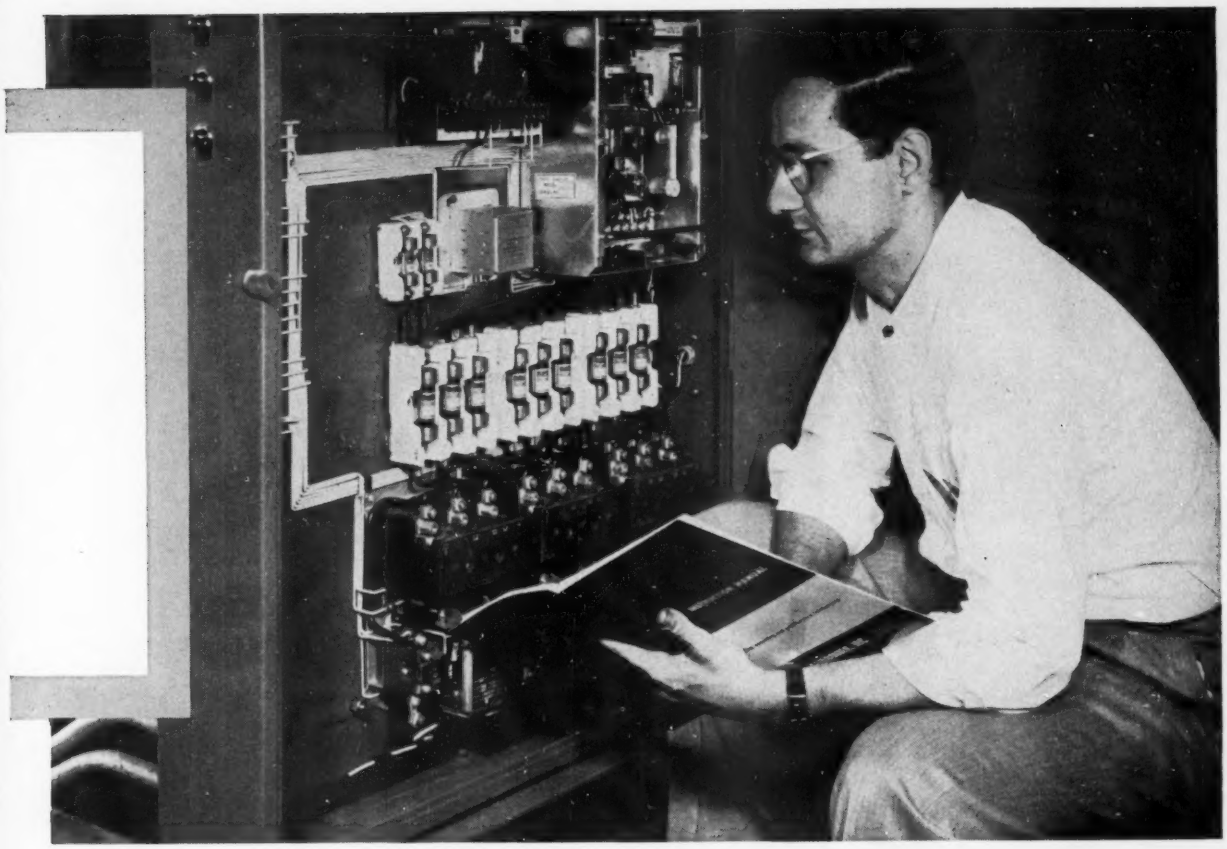
"If the Fusetron fuses had not opened, the motor would undoubtedly have burned out.

"Now on all our Powermaster Steam Generator Units we use Fusetron Fuses to protect the motors on the fuel pump, the boiler feedwater makeup pump, and the air compressor."

Franklin Van Reed
Production Engineering Supervisor
ORR & SEMBOWER, INC.,
Reading, Pennsylvania







You, too, can profit by the

10 POINT PROTECTION of Fusetron Dual-Element Fuses . . .

1 Protect against short-circuits.*
2 Protect against needless blows caused by harmless overloads.
3 Protect against needless blows caused by excessive heating — lesser resistance results in much cooler operation.
4 Provide thermal protection — for panels and switches against damage from heating due to poor contact.
5 Protect motors against burnout from overloading.
6 Protect motors against burnout due to single phasing.
7 Give DOUBLE burnout protection to large motors — without extra cost.
8 Make protection of small motors simple and inexpensive.
9 Protect against waste of space and money—permit use of proper size switches and panels.
10 Protect coils, transformers and solenoids against burnout.

*Fusetron Fuses have high interrupting capacity as shown by tests of the Electrical Testing Laboratories of New York City in December 1947.

FUSETRON is a trade mark of the Bussmann Mfg. Co., Division of McGraw Electric Co.

THE MONEY YOU SAVE . . . by preventing one **needless** shutdown, one **lost** motor, one **destroyed** switch or panel or one **burned out** solenoid . . . MAY MORE THAN PAY FOR the replacement of all your ordinary fuses with Fusetron dual-element Fuses.

THIS COUPON WILL BRING YOU complete information about the All-Purpose Protection of FUSETRON Dual-Element FUSES

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

Bussmann Mfg. Co., University at Jefferson, St. Louis 7, Mo. (Division of McGraw Electric Co.)

Please send me complete facts about FUSETRON dual-element Fuses.

Name_____

Title_____

Company _____

Address _____

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Short on Erection Time—
Long on Service Life—

BYERS WROUGHT IRON PLATES

Minimum interference with production routine —during installation—and in years to come— is the story behind the selection of genuine wrought iron plate for this smokestack.

The Farrington Manufacturing Company, Boston, needed a stack for their No. 2 Plant *in a hurry*—made of a material that would *slow-down* the corrosive effect of flue gases created by the plant's incinerator and oil-fired heating boiler.

Company engineers found the answer to both problems in genuine wrought iron plate.

The stack, 100 feet high by four feet in diameter, was prefabricated in three sections at the C-W Boiler Company Shop, Holliston, Mass. These sections were trucked to the plant site, welded together, and erected in one day.

Proved corrosion resistance to flue gases and ease of fabrication and welding are outstanding characteristics of Byers Wrought Iron plate. This double advantage has recommended the material for stack use in installations across the nation, and the resulting service records provide convincing evidence of its superior durability.

How the unique character of Byers Wrought Iron plate has made it a veteran in stack service is explained in our bulletin, WROUGHT IRON FOR FLUE GAS CONDUCTORS AND COAL HANDLING EQUIPMENT. Write for your copy. It may help you in combating flue gas corrosion in your operation.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Division: New York, New York.

BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

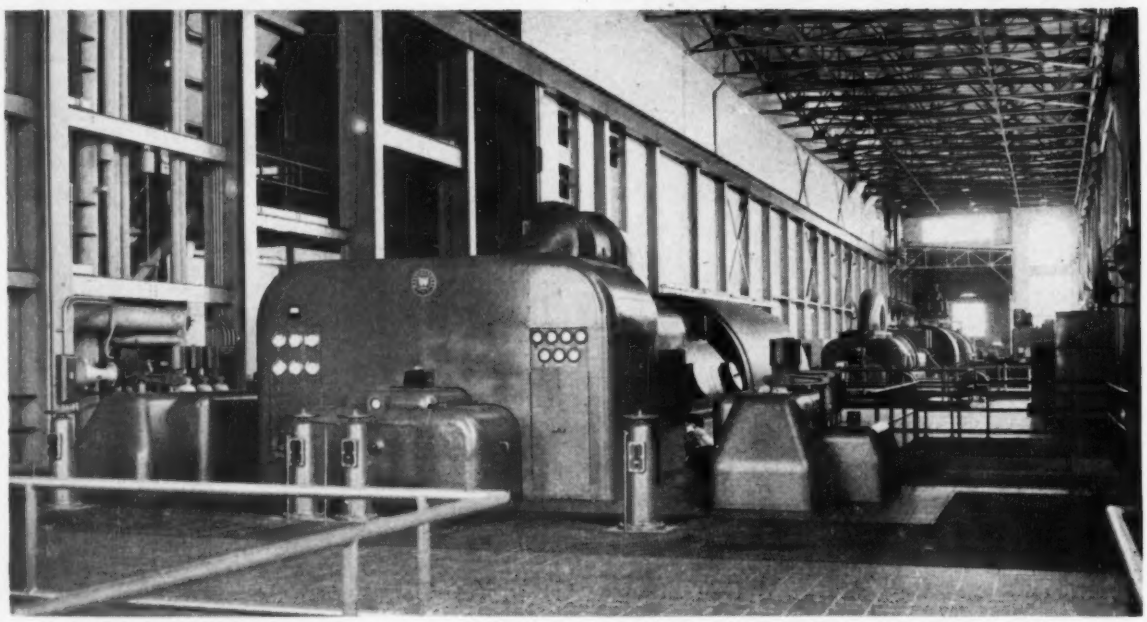
GOUDEY STATION shows 34 years of progress in central station practice. Right to left, four successive installations use 200, 400, 850 and 1450 psig steam pressures. New weir in river insures ample cooling water during the summer months

Reheat Unit Extends Goudey Capacity

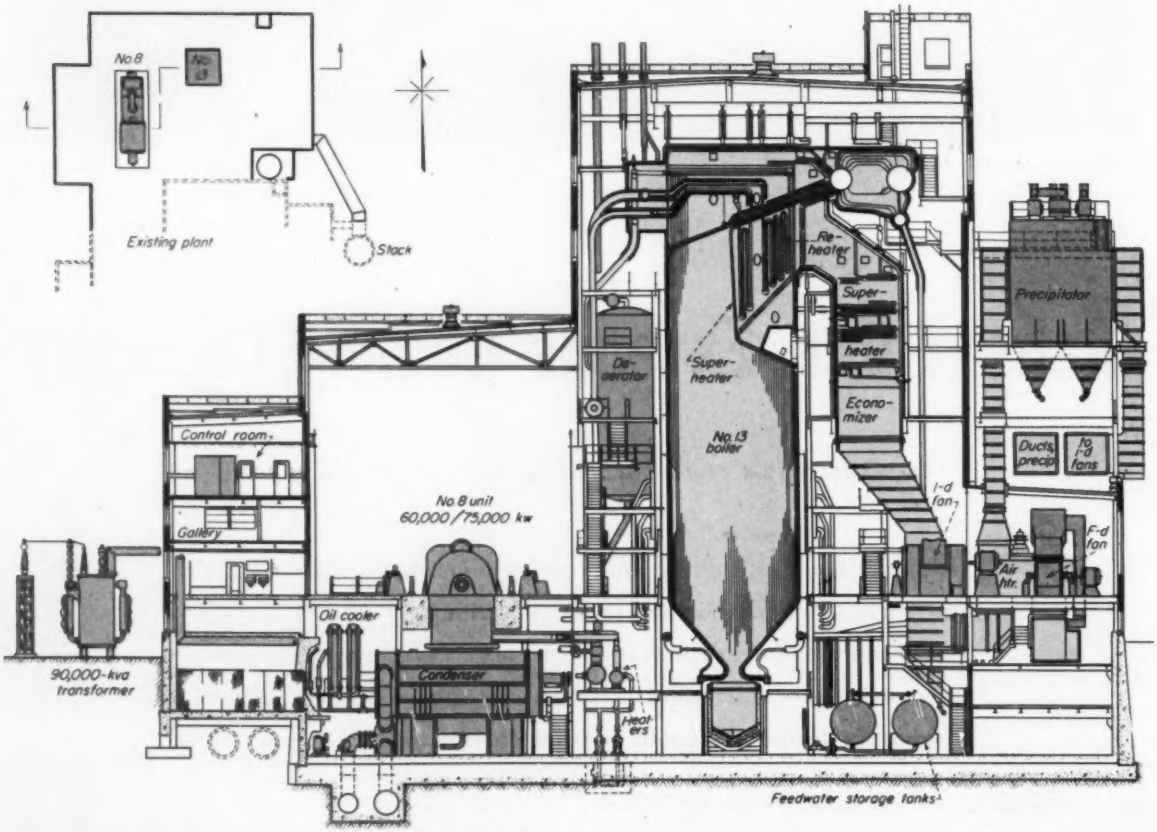
By **W GREACEN 3rd**, *Chief Mechanical Engineer, New York State Electric & Gas Corp*

Installing the first reheat unit on system at multipressure station proved most economical compared with new sites. Uncoupling main generator from turbine allows its use as synchronous condenser for power-factor correction. Electrical control room for all units is separate from boiler and turbine control room on main floor

TURN PAGE



NO. 8 REHEAT UNIT rated at 60/75 mw uses 1000/1000 F steam temperatures, 1450-psig throttle pressure. Only 5 of 6 bleed points are used for feedwater heating and evaporator supply. Generating capacity of 8 units adds up to 174,000 kw



SINGLE 560,000-LB-PER-HR reheat boiler feeds turbine. Two-stage superheater controlled by water attemperation as well as the single-stage reheater. Two sets of f-d and i-d fans serve boiler. Precipitator discharges flue gas to an existing stack

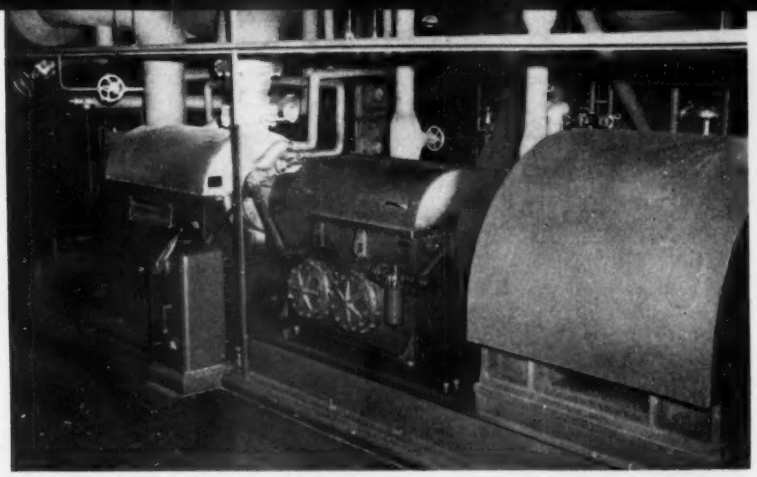
New Unit Gave Welcome Opportunity to Build Modern Electrical Control Room For All Units in Station

► GOUDEY STATION on the Susquehanna River in Johnson City, N. Y. now has four steam-pressure levels with the addition of the first reheat unit on the N. Y. State Electric & Gas system. Studies showed that installing the new unit at Goudey yielded substantial savings over a new site. A weir placed across the river solved the principal problem of adequate cooling-water supply.

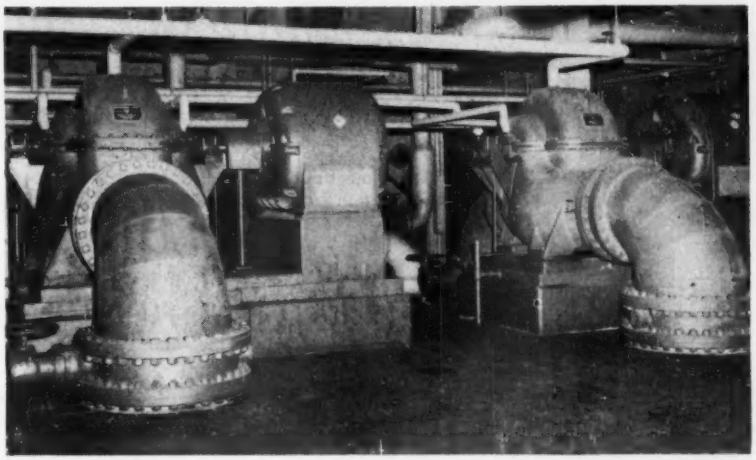
We are experimenting with various types of coal spouts between bunkers and feeders. Three of them, of rectangular cross section, taper to narrower cross sections at feeder inlets. Two of these have $\frac{3}{8}$-in. 20% stainless clad steel in the upper section and $\frac{1}{4}$-in. carbon steel lined with $\frac{1}{8}$-in. stainless steel in the lower section. The third has $\frac{3}{8}$-in. carbon steel lined with $\frac{1}{2}$-in. rubber. The remaining chute is a 24-in.-dia round-flanged rubber pipe connected to the feeder through a stainless-steel lined adapter.

An air-conditioned control room on the main floor houses controls and major instruments for boiler and turbine. Three-element feedwater control and combustion controls are major components in this room.

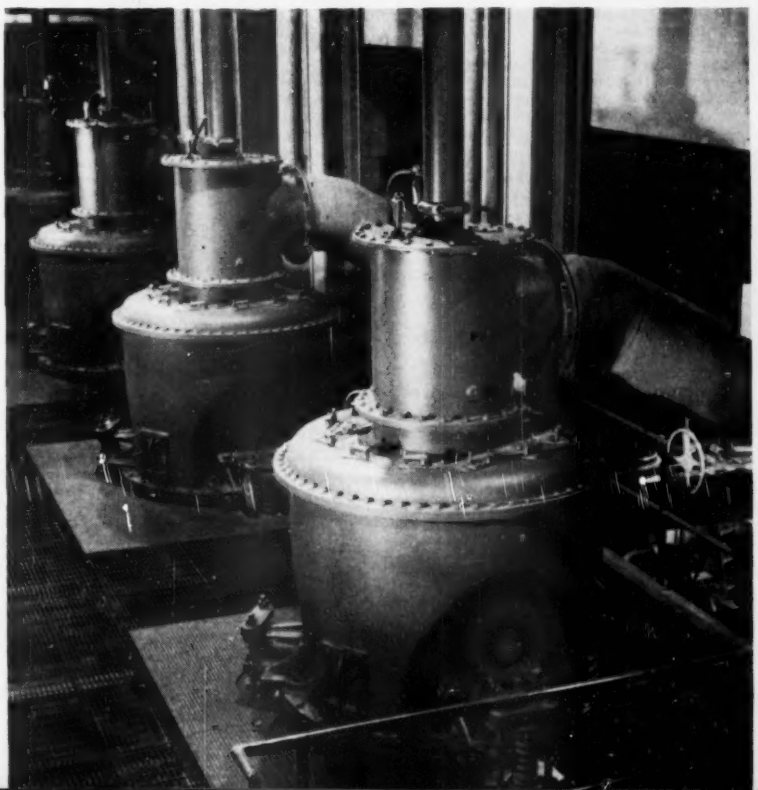
The new unit started Dec. 17, 1951. With exception of some very minor difficulties this was the most successful start we have had. We attribute this



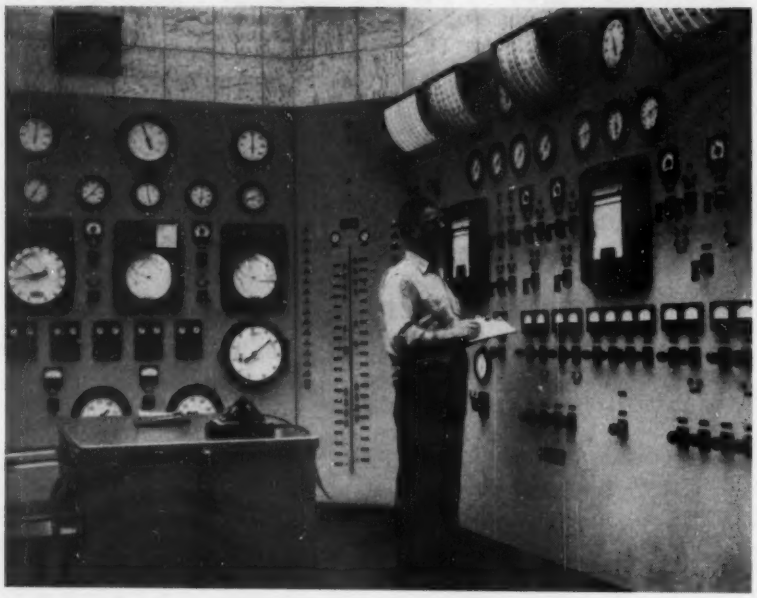
EACH OF TWO BOILER FEED PUMPS can carry full boiler load, 630,000 lb per hr at 1682 psig; 2000-hp electric motors drive pumps through hydraulic couplings



TWO HORIZONTAL SINGLE-STAGE centrifugal pumps develop 37-ft total head to pass 20,500 gpm water through 42,500 sq ft, 2-pass condenser, reversing valves



BOWL-TYPE PULVERIZERS each handle 21,600-lb-per-hr coal. Three mills, grinding normal coal, supply full-load boiler demand. Integral exhausters, 250-hp drive motors, main parts of mill stand immediately below grating. Permanent 10-ton crane eases maintenance work



BOILER AND TURBINE CONTROL ROOM measures 10x27 ft, has control boards on three sides. Mill feeders can be seen through glass-paneled fourth side by operator

partly to: (1) an operator training program (2) thorough checking of auxiliaries as each was completed before turbine completion (3) careful checking of controls, miscellaneous drips and drains (4) detailed schedule prepared of equipment checked, lubricated, operated, etc (5) complete cooperation between company and consultants.

Acceptance tests showed that the equipment is within guarantee in respect to heat rate. Design heat rates for the new unit are:

Generator load, kw	*Turbine heat rate, Btu/kwhr*	*Station net heat rate, Btu/kwhr*	*Boiler effy, %*
15,000	9,980	12,039	89.71
30,000	8,790	10,610	89.65
45,000	8,340	10,075	89.57
60,000	8,165	9,876	89.46
75,000	8,175	9,906	89.31

The unit steam generator is fired with four bowl mills, any three of which will carry full load with coal of normal analysis. The tangentially-firing tilting

PRINCIPAL POWER-PLANT EQUIPMENT

POWER-GENERATING EQUIPMENT:

Turbine-generator, 1 ..... Westinghouse Electric Corp
Tandem compound, double flow, 60,000/75,000 kw, 1450-psig 1000-F throttle steam, 1000-F reheat, 1 in. Hg abs exhaust, 3600 rpm, 6 bleed points, 1 blanked off, 30-psig H_2 pressure

Condenser, 1 ..... Foster-Wheeler Corp
42,500-sq-ft surface, 2-pass, divided steel waterbox, 7130 arsenical admiralty tubes, 7/8-in. OD, No. 18 BWG, 26 ft long, Muntz metal tube sheets

Circulating-water pumps, 2 ..... Foster-Wheeler Corp
Horizontal, centrifugal, single-stage, double-entry, 20,500 gpm at 95 F, 37-ft total head

Circulating pump drives, 2 ..... Allis-Chalmers Manufacturing Co
250-hp motors, 580 rpm, 3-phase, 60-cycle, 2300-v

Air ejector, twin steam elements, 2-stage, 1 ..... Foster Wheeler Corp

Vacuum priming pump, 1 ..... Nash Engineering Co

FEEDWATER EQUIPMENT:

Evaporator, 1 ..... Lummus Co
Bubble tray type, 100 U-tubes, 70-30 Cu-Ni, 3/4-in. OD, No. 18 BWG, 16 ft long, 632 sq ft surface

Evaporator level control, 1 ..... Climax Controls Div, Black, Sivalls & Bryson, Inc

Evaporator condenser, 1 ..... Lummus Co
Reflux type, 46 U-tubes, arsenical copper, 3/4-in. OD, No. 18 BWG, 3-ft straight length, 54 sq ft heating surface

Evaporator blowdown heat exchanger, 1 ..... Graham Mfg Co

No. 1 heater, 1 ..... Westinghouse Electric Corp
Closed, horizontal, 4 pass, 486 U-tubes, admiralty, 5/8 in. OD, No. 18 BWG, 200-psi tube pressure, 30-psi shell, drain cooler, 15 ft 3 1/4 in. active length of tubes

No. 2 heater, 1 ..... Westinghouse Electric Corp
Closed, horizontal, 2 pass, 269 U-tubes, admiralty, 5/8 in. OD, No. 18 BWG, 24 ft active length, 200-psi tube, 50-psi shell pressures, drain cooler section

No. 3 deaerating heater, 1 ..... Cochrane Corp
Jet, tray type, 560,000 lb per hr, mounted on vertical 20,000-gal storage section, vent condenser

No. 4 heater, 1 ..... Westinghouse Electric Corp
Closed, horizontal, 2 pass, 414 U-tubes, 70-30 Cu-Ni, 5/8-in. OD, No. 14 and 15 BWG, 23 ft 6 5/8 in. active length, 2400-psig tubes, 250-psig shell, drain cooler, desuperheating sections

No. 5 heater, 1 ..... Westinghouse Electric Corp
Same as No. 4 heater except 525-psig shell pressure, also has drain cooler, desuperheating sections, but different tube spacing

Heater level controls ..... Climax Controls Div, Black, Sivalls & Bryson, Inc, Swartwout Co

Boiler feed pumps, 2 ..... Ingersoll-Rand Co
Horizontal, 10-stage barrel type, 630,000 lb per hr at 280 F, 1682 psig, 3460 rpm

Feed-pump hydraulic couplings, 2 ..... American Blower Co

Boiler feed pump drives, 2 ..... Westinghouse Electric Corp
2000 hp, 3 phase, 60 cycle, 2300-v motor

STEAM-GENERATING EQUIPMENT:

Boiler, 1 ..... Combustion Engineering-Superheater Inc
3 drum, bent tube, reheat, completely watercooled, 560,000 lb per hr, 1465 psig, 1005 F at superheater and reheater outlets, furnace volume of 44,600 cu ft, 29,250 sq ft waterwall surface

Superheater, 1 ..... Combustion Engineering-Superheater Inc
2 stage, 34,700 sq ft heating surface, superheat control by 2-stage steam-atomized water attemperation

Reheater, 1 ..... Combustion Engineering-Superheater Inc
Single stage, 9000 sq ft heating surface, spray attemperation

Economizer, 1 ..... Combustion Engineering-Superheater Inc
Continuous fin tube, 13,310 sq ft heating surface

Air preheaters, 2 ..... Air Preheater Corp
Ljungstrom regenerative, vertical shaft, 115,000 sq ft

Forced-draft fans, 2 ..... Westinghouse Electric Corp (Sturtevant Div)
101,000 cfm, 100 F, 11 in. wg static press, vane control, 1180 rpm

F-d fan motor drive, 2 ..... Elliott Co
250 hp, 3 phase, 60 cycle, 2300 v

Induced-draft fans, 2 ..... Westinghouse Electric Corp (Sturtevant Div)
161,000 cfm, 264 F, 14.9 in. wg static press., vane control, 880 rpm

I-d fan drives, 2 ..... Elliott Co
600 hp, 3 phase, 60 cycle, 2300 v

Pulverizers, 4 ..... Combustion Engineering-Superheater Inc
21,600 lb per hr, bowl type, integral exhauster, grinds 60 hardgrove bituminous

Pulverizer drives, 4 ..... Allis-Chalmers Mfg Co
250 hp, 3 phase, 60 cycle, 2300 v

Burners, coal, 16 ..... Combustion Engineering-Superheater Inc
Tilting, pulverized coal, four tiers

Burners, oil ..... Combustion Engineering-Superheater Inc
12 air-atomizing ignition torches, 4 air-atomizing warm-up torches, provisions for 12 mechanical atomizing torches to generate steam at 560,000 lb per hr

Electrostatic precipitator ..... Research Corp
6.2 fps gas velocity, 2.92 sec treatment time, 32-34 kw power consumption at 253,000 cfm, 98% collection efficiency

Soot blowers ..... Diamond Power Specialty Corp
Sequential control, 16 short and 10 long retractable blowers, space for 6 more long retractable blowers, steam at 400 psig and 700 F from low-pressure section of station

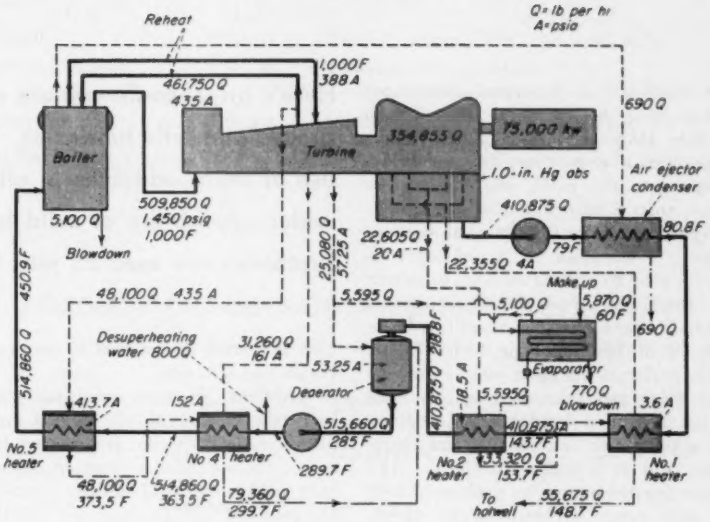
Ash and dust handling ..... United Conveyor Corp

Coal conveying equipment ..... The Jeffrey Manufacturing Co

burners use the tilting feature to control final reheat temperature. Some of the features of the new steam generator include furnace television, remote-controlled burner ignition and air-conditioned control rooms.

The main condenser has divided waterboxes and two water passes. Motor-operated reversing valves help keep the tube sheet clean. In the feed heating system the two high-pressure heater drains cascade to the deaerator while the two low-pressure heater drains cascade back to the main condenser.

The generator is designed to run as a synchronous condenser when disconnected from the turbine. Two turning gear motors, one at 3 rpm and the other at 30 rpm, connect to the generator end of the shaft at the coupling. They assist in bringing up generator speed in preparation for condenser operation. The only changes needed to convert to this type of operation is to remove the coupling and insert a thrust bearing at that point. A 225-kw motor-generator set supplies excitation when the generator runs as a synchronous condenser.



STATION HEAT-BALANCE CYCLE uses deaerating heater, four closed heaters. Drain-cooling sections are in all heaters, h-p heaters have desuperheating sections

No. 8 Unit, Goudey Station, Johnson City, N. Y., New York State Electric & Gas Corp

PUMPS:

Main burner oil pumps, 2 ..... DeLaval Steam Turbine Co
Imo type, 3600 gph at 300 psig
Burner pump drives, 2 ..... The Louis Allis Co
20 hp, 3 phase, 60 cycle, 220 v, 1750 rpm
Warm-up burner pump, 1 ..... DeLaval Steam Turbine Co
Imo type, 480 gph, 150 psig, 3-hp motor drive... The Louis Allis Co
Pilot burner pump, 2 ..... DeLaval Steam Turbine Co
Imo type, 100 gph, 35 psig, ½ hp motor drive.... The Louis Allis Co
Ash vacuum pump, 1 ..... Allis-Chalmers Manufacturing Co
Centrifugal, single stage, double suction, 900 gpm, 400-ft tdh
Hydrogen & oil cooler pump, 1... Pennsylvania Pump & Compressor Co
Single stage, double suction, 600 gpm, 50-ft tdh, 10-hp motor drive—The Louis Allis Co
Lube-oil transfer pump, 1 ..... Viking Pump Co
150 gpm, 30 psig, 7.5-hp motor drive—The Louis Allis Co
Condensate-return unit, 1 ..... Gould Pumps, Inc
Two centrifugal 50 gpm at 240-ft tdh, 7.5-hp motor drive—Allis-Chalmers Mfg Co, Hanlon Waters throttle-type control
Condensate-transfer pump, 1 ..... Gould Pumps, Inc
Centrifugal, 2 stage, 400 gpm, 200 F, 240-ft tdh
Transfer pump drives, 1 ..... Allis-Chalmers Manufacturing Co
40 hp, 3 phase, 60 cycle, 220 v, 1750 rpm
Sump pump, 2 ..... The La Bour Co, Inc
Horizontal, centrifugal, self-priming, 300 gpm, 50-ft tdh, 15-hp motor drive, 1150 rpm, 220 v
House service pump, 1 ..... Pennsylvania Pump & Compressor Co
Single stage, double suction, 800 gpm, 150-ft tdh
House-service pump drive, 1 ..... Allis-Chalmers Manufacturing Co
40 hp, 1800 rpm, 3 phase, 60 cycle, 220 v
Evaporator blowdown pump, 1 ..... Warren Pump Co
Recirculation + 10 gpm at 56-ft tdh, ¾-hp motor drive
City-water booster pump, 1 ..... Gould Pumps, Inc
Single stage, double suction, 400 gpm, 52-psig boost
Booster pump drive, 1 ..... Allis-Chalmers Manufacturing Co
20 hp, 3 phase, 60 cycle, 220 v
High-pressure chemical feed pumps, 2 ..... Orlich Brothers
One, 90 gph; one, 2 gph, 2500 psig, 90-F solution
Brine pumps, 2 ..... Gould Pumps, Inc
Centrifugal, 4 gpm, 50-ft tdh, ⅓-hp motor drive—General Electric

INSTRUMENTS AND CONTROLS:

Combustion control ..... Leeds & Northrup Co
Recorders ..... Leeds & Northrup Co
CO_2, conductivity, temperature, boiler temperatures, steam temperature, feedwater and condensate tmperature, condenser temperature, bearing oil temperature
Multipoint draft gage ..... Hays Corp
Flowmeters ..... Bailey Meter Co
Boiler air and steam, feedwater, condensate, feed pump flow and recirculation, boiler-water level
Pressure gages ..... Ashcroft—Manning, Maxwell & Moore, Inc
Level controls, gland water tank, evaporator coil drain.....
..... Climax Controls Div, Black, Sivalls & Bryson, Inc
Control air compressor ..... Pennsylvania Pump & Compressor Co
76-cfm free air, 100 psig, single stage, double acting, 20-hp motor drive, 1800 rpm

MISCELLANEOUS EQUIPMENT:

Station air compressor, 1..... Pennsylvania Pump & Compressor Co
Single stage, double acting, 310 cfm free air, 100 psig, 1200 rpm, 75-hp motor drive
High-pressure valves above 2 in. ..... Crane Co
High-pressure valves, 2 in. and smaller.. Manning, Maxwell & Moore, Inc
High-pressure drain valves, steam traps..... Yarnall-Waring Co
Iron body valves..... R P & C Valve Div, American Chain & Cable Co
Brass body valves ..... Lunkenheimer Co; Walworth Co
Reverse current valves ..... Atwood & Morrill Co
Circulating-water butterfly valves ..... Henry Pratt Co
Rubber expansion joints ..... Garlock Packing Co
Miscellaneous valves ..... Chapman Valve & Mfg Co; Nordstrom Valve Div, Rockwell Mfg Co
Softener and pressure filter ..... Permutit Co
Fuel-oil strainers, 5 ..... Cuno Engineering Corp
Fuel-oil meters, 3 ..... Buffalo Meter Co
Desuperheater control valves..... Copes-Vulcan Div, Continental Foundry & Machine Co
Bowl mill dismantling crane, 10 ton ..... Louden Machinery Co
Electric vibrator ..... Syntron Co
Turbine-oil purifier, 450 gph ..... DeLaval Steam Turbine Co
Boiler, turbine & house service piping..... M W Kellogg Co
Structural-steel fabrication, erection ..... American Bridge Co
Equipment insulation ..... Johns-Manville
Reinforcing steel ..... Bethlehem Steel Co
Breeching, ducts, hoppers, circulating piping.....
..... Connery Construction Co
Steel gratings ..... Kerrigan Iron Works
Roof ventilators ..... H H Robertson Co
Unit ventilators ..... Trane Co; Buffalo Forge Co; G C Breidert Co
Unit heaters ..... Trane Co

CONSULTING ENGINEERS ..... Gilbert Associates Inc

Industrial Lubricants...Today

Here's an up-to-the-minute summary of today's picture on oil, grease and solid lubricants. Briefly, the trend continues toward use of more additives in oil, many different soaps in grease, wider application of solid lubes if oil or grease is not suited. Synthetics are used on jobs falling beyond petroleum's scope*

► CHANGES in industrial lubrication have come in the form of evolution rather than revolution. Each change has been a step-by-step process bringing us to the point where today we look upon a lubricant in a sharply different light from that of some decades past. Conception of a lubricant in years gone by was "a medium to reduce friction and wear between moving parts." But today's lubricant is a versatile, multi-functional product. It not only performs the basic jobs of preventing wear and friction, but also must often act as a heat-transfer medium, as a protective against rust and corrosion, and as a sealing medium. And these functions must be performed over a wide range of temperature, speed, load and operating time.

This transition to a multi-functional performance status has led to the widespread use of performance evaluation testing rather than specifications alone; also, the use of field testing when new products are introduced.

OILS

One significant advance in the field of industrial oils centered about the ASTM oxidation test for turbine oils. At present it is generally accepted practice to include a 1000-hr minimum for this test in many specifications. In the field of diesel lubrication there is a growing trend toward higher detergent oils in the smaller units. This is especially true in the presence of high sulfur fuels. It is not unusual to have an oil-detergent content between 15 and 18% by volume. But the larger diesels still use little or no detergent.

Way lubricants for machine tools are going through a change. Many lubricants now available meet the present needs for (1) coefficient of kinetic friction higher than static (2) greater adhesion to hold the lube in place on machine way.

Synthetic liquids that have received the greatest attention in the past 10 years are the aliphatic esters, the polyalkylene oxides, the silicones, esters of phosphoric and silicic acids and the highly fluorine-substituted hydrocarbons. In general, synthetics fill the bill for applications that can't be matched with petroleum products. They are relatively expensive.

One specific synthetic that has made a bow in the power field is the polybutene-type fluid with or without graphite. This is finding application in oven-conveyors and kiln cars.

Additives. In many applications the best refined mineral oils do not completely satisfy specific service requirements. So to meet this situation refiners have gone to chemical additives that are compounded with the base oil. For the most part these agents enhance the natural properties of the oil and make it more durable. Amount and type of additive is determined by the application. For instance, in steam turbine oil, small amounts of an oxidation inhibitor, a rust inhibitor, and an anti-foam agent generally satisfy the toughest applications. In contrast, gear oils often contain lead, chlorine, sulfur and phosphorous type additives, plus pour depressants, and anti-foam agents.

GREASES

In the broad sense a grease is a 2-component system; one the fluid, the other the gelling agent. Fluid is usually the major portion of the grease. Fluids today cover a wide range of liquids from mineral oils to synthetics. Mineral oils were the first fluids in grease manufacture and still account for the largest volume of grease manufactured. Mineral oils vary anywhere from special kerosene cuts to heavy cylinder oils. And that includes waxes, petrolatums and asphalts. Other fluids are vegetable oils (like castor oil), esters of dibasic acids, polyglycols, silicones, etc.

Gelling Agents. Next, there are the gelling or thickening agents to build the grease structure. Years back these were all the soap type. Often the soaps were similar to our familiar hand or laundry soap. Soaps of almost every metallic base have been used at some time. The most common ones at present are sodium, calcium, aluminum, barium and lithium. Strontium, lead and iron soaps have also been used for certain special applications.

Recent developments show that a grease can be made by many agents other than the conventional soaps. Among these are what we may classify as the specialty soaps. Here the metallic part is quite familiar to us, but the fatty component is either a special fraction of a natural fat or one that has been processed to give it properties not found in natural fats. An example is the hydroxy stearates. Other gelling materials, ranging from inorganics to synthetic resins, and carbon black are used.

Among the inorganic gelling agents are the Bentones; 8 to 10% of such material will give a grease-like structure to a mineral oil. Greases are also available that use 5 to 10% silica aerogel. The aerogel is a specially prepared silicon dioxide having a thickening property.

Bentonite greases boast a high dropping point (about 500 F) and show little change in body over a wide temperature range. On the negative side of the ledger they are relatively costly and tend to lose their structure when operated under high shear at room temperature. Silica aerogel greases have similar advantages and disadvantages. But most of the existing disadvantages can possibly be overcome with suitable additives.

Recently copper phthalocyanine was introduced as a gelling agent. It is used in amounts up to 25% to "fix" a fluid into a grease-like structure. When used as a thickening agent for the phenyl silicones they yield greases that are satisfactory at higher temperatures, 400-450 F.

Gelling agents, like silicones, asbestos, mica, nylon fibers, have been produced. But their use to date has been for highly specialized applications. In general, synthetic greases find limited application, the reason being their cost compared with petroleum greases.

*Most of this information is based on a free adaptation from New Development Forum presented at December 11, 1952 meeting, N. Y. Section of American Society of Lubrication Engineers. Speakers were W H White, Esso Standard Oil Co of N. Y.; C D Thayer, Socony-Vacuum Oil Co; W E Campbell, Bell Telephone Laboratories.

Military Needs. The Armed Forces have played a big part in development of new greases. They furnished the original impetus for production of lithium soap greases. Likewise, the extreme temperature applications the Armed Forces wrestle with showed the need for a lubricant other than a petroleum product. These wide temperature needs paved the way for the synthetic fluids. Where greases are made with a fluid other than a petroleum product they are labeled synthetic greases.

The many greases listed in tables, at right, certainly don't represent the major volume of greases manufactured. But they do satisfy the needs in one of the most critical portions of the total volume. Note the greases listed are designed to do their job at temperatures outside those normally met in industry.

Lithium soaps came into use during the last war. Since then there has been a big increase in their application in both the industrial and automotive fields. Many greases, lithium among them, come under a multi-purpose heading. In brief, that means they are pegged as a single grease that meets many individual requirements.

SOLID LUBRICANTS

Some solid minerals, for instance graphite, mica, talc and soapstone have lubricating properties. And there are chemical compounds too. Two typical solid lubricants are graphite and molybdenum disulfide. Graphite may be further classified as natural or synthetic.

Natural graphite is a black, lustrous mineral used as a lubricant either in dry form or mixed with oil or grease. Synthetic graphite is manufactured in an electric furnace from anthracite coal and petroleum coke. Used with other materials, graphite serves as an electrical conductor and lubricant in motor brushes. It comes into play in manufacturing oil-less bearings; sometimes in paste form, in solid rods, or combined with powdered metals.

Both natural and synthetic graphite are identical in structure and properties. Only fundamental difference is particle size; synthetic graphite may have a higher purity.

Molybdenum disulfide is a chemical combination of molybdenum and sulfur, closely resembles graphite in structure, and has twice its density. Molybdenum disulfide is also a good high-temperature lubricant especially in vacuum or inert gases. In oxygen it changes to moly oxide, which is abrasive above 400 C.

Basis for the lubricating action of

(*Continued on page* 206)

SYNTHETIC GREASES MEET WIDE TEMPERATURE DEMANDS

Grease Composition		Applications	Temp Range, F
Fluid	Soap		
Diester	Lithium	General aircraft use	—60 to 250
Phenylsilicone	Lithium	Bearings for silcone-insulated electric motors	0 to 300
Diester	Lithium	Instruments	—65 to 250

MILITARY NEEDS for extreme-temperature greases absorb major part of synthetics

PETROLEUM GREASES SATISFY MOST NEEDS IN INDUSTRY

Grease Composition		Applications	Temp Range, F
Fluid	Soap		
High-vis mineral oil	Sodium, barium, lithium	Electrical equipment operating above 250 F	Up to 300 F
Low-vis mineral oil	Lithium	Automotive	—65 to 125
Low-vis mineral oil	Sodium, lithium	Aircraft	

LITHIUM GREASE is one type now finding wide use as a multi-purpose lubricant

PERFORMANCE CHARACTERISTICS OF VARIOUS GREASES

Grease	Max Temp, F	Min Temp, F	Lubricity	Cost per lb
Silicone	338	—31	Poor	$6.50
Polyester	302	—58	Good	2.00
Silicone diester	284	—112	Poor	6.50
Diester	266	—76	Good	2.00
Polyglycol	239	—31	Fair	1.75
Petroleum	239	—22	Good	0.20

NOTE: Maximum temperatures shown are for 1000-hr life test. Minimum temperature is the lowest temperature the grease can reach and yet satisfy a 1000 gm cm torque test in a No. 204 bearing. Lubricity data are based on results of Navy Gear Wear tester; brass-stainless comb.

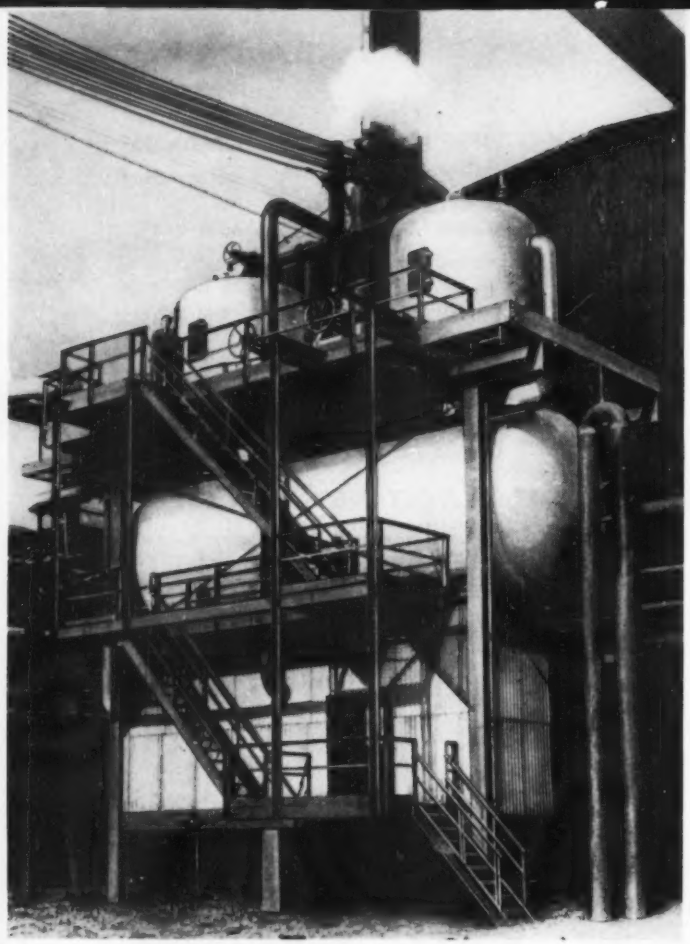
GREASE SELECTION often calls for study of more characteristics than those above

FRICTIONAL CHARACTERISTICS OF TYPICAL SOLID LUBES

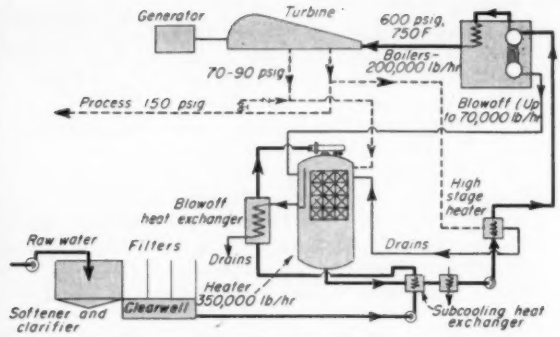
Class	Example	Shear Strength	Adhesion	Mobility	High-Temp Stability
Soaps, waxes	Magnesium stearate, beeswax	A	C	C	D-F
Laminar solids	Graphite, molybdenum disulfide	A	D	F	A
Chemical coatings	Sulfides, phosphates	C	A	F	A
Soft metals	Lead, indium, zinc	A	A	F	B-C
Plastics	Teflon, phenolics	A	B-F	F	B-D

Code: A—excellent, B—very good, C—good, D—fair, F—poor

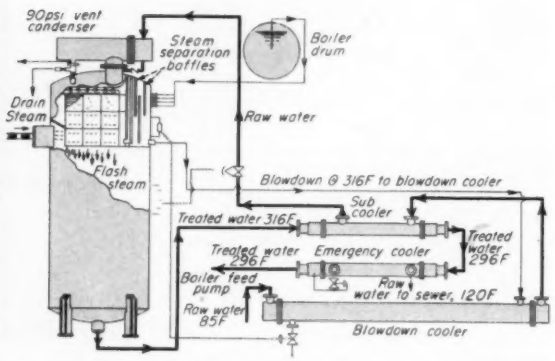
SOLID LUBRICANTS fit in where oil, grease fall short. Here are some to consider



MODERN DEAERATOR designs meet wide range of wants, table, p 80, with relatively few basic types. Problem is application



1 Incoming water, high in non-carbonate salts, treated externally gives a supply water of high total dissolved solids



2 Deaerator selected for case in Fig. 1, features tray design that removes most of dissolved oxygen in first stage

Deaerating Heater Proves Versatile

By **V J CALISE and R K STENARD**
Graver Water Conditioning Co

•Large, constantly expanding industrial plants need ever greater supplies of immediately available heated and also deaerated feedwater

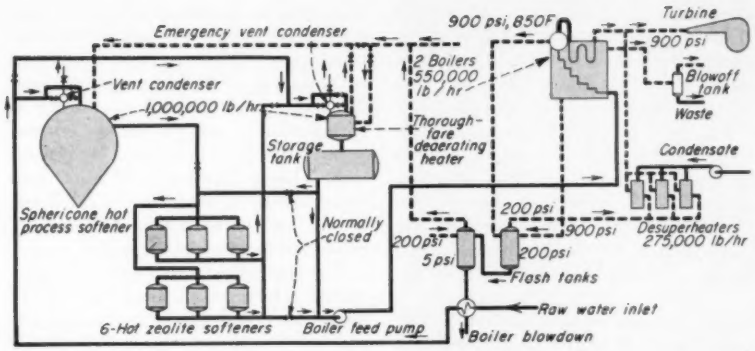
• A direct-contact heater is a natural in this setup since it can scavenge heat from many sources like condensate, waste, exhaust and flash steam

► BOILER-FEEDWATER direct - contact heaters were developed originally to effect fuel savings by recovering heat in the steam discharged from engines or turbines. As boiler pressures and temperatures increased, economizers, stage heaters, extraction and condensing turbines came along as further fuel-savings devices to increase the over-all power-plant thermal efficiency. Relative importance of the deaerating heater shifted. It became the prime tool in corrosion protection of boilers, feedwater lines, turbines and accessories.

Today's large, constantly expanding industrial, though, finds it profitable to reverse the trend in some cases. Here the deaerating heater serves as a scavenger for absorbing and utilizing heat, not only in waste and in exhaust steam, but also in condensate-flashed steam and in condensate returns from process, in flashed steam from blowdown and in cooling water. This role for the deaerator fits in perfectly with industrial-plant demand for greater quantities of immediately available, heated, deaerated feedwater.

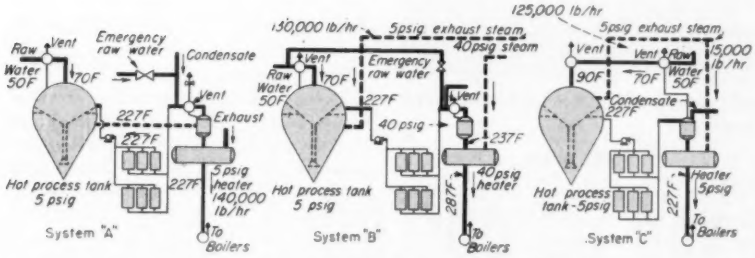
Range of processes and individual heater applications, industry to industry, differ so widely that highly flexible yet specially tailored heater designs have had to be developed. Some of the problems these designs meet—unusual variations in power and steam loads, extreme penalties from outage produced by boiler-feed-pump seizure—have led to greater emphasis on npsh (net positive suction head) pump applications. Other problems have produced interesting considerations influencing selection, application and arrangement of the proper heating details.

Table on p 80 summarizes heater designs with the many special features and modifications that modern boiler-

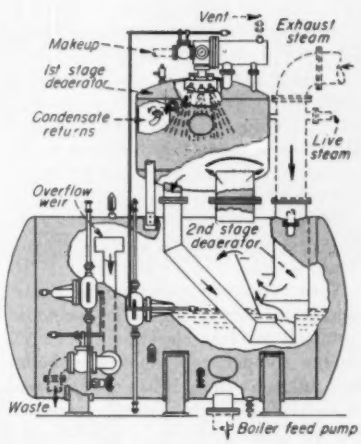


3 Sphericone hot-process softener plus zeolite treatment gives high pH, low hardness, partially deaerated water, so deaerator should give a low operating cost

Few Basic Deaerator Designs, Wisely Applied, Add Flexibility, Save Money for Industrials



4 Three possible deaerator arrangements could meet conditions of Fig. 3. Scheme A, above, won because it gave best operation under all loads, water conditions



5 About 166,700 lb of deaerated water, for Fig. 3, can be stored

Tool in Large, Expanding Plants

plant operation requires. We have seen these basic types solve a number of highly specialized problems. Here are two interesting examples.

Chemical Process. Recently a Southwestern chemical manufacturer expanded facilities at a new location and put in 600-psig 750-F boilers operating on 90-100% makeup with extraction turbines for power and process steam production, Fig. 1.

Incoming river water runs high in nonhardness or noncarbonate salts and silica at times, making it necessary to set up an external water-treatment system. This treatment involved lime, a coagulant and chlorine in a high-rate sludge-contact arrangement, followed by a cold-process softener, a filtering operation and further softening in zeolite softeners. The treated water was then scheduled for admission to a deaerating heater.

Selection of the deaerator involved six considerations: (1) design of internals—tray against spray (2) tubular vent condenser choice—external or internal (3) steam recovery—how much flash from blowdown and how much blowdown recovery (4) storage—what was a desirable quantity of deaerated water to steam (5) construction materials—what metals for corrosive areas (6) allowable costs to get a npsh—subcooling method against heater elevation.

Design. Little or no condensate gets back to the heater in normal operation, but provision for about 10% went into the design planning. Incoming treated water carries as high as 800 ppm of dissolved solids (average 320 ppm) with a total hardness under 1 ppm and a methyl orange or carbonate reading below 35 ppm. Solids exist mostly as sodium salts (NaCl and Na_2SO_4). Up to 8 ppm of oxygen comes in with the feedwater.

This oxygen has to be removed at the heater's top from a makeup water of 10.2 pH at temperatures ranging from 75-115 F. Accordingly, the designers favored weir-edge, stainless-steel, noncorrosive trays set up in three tiers. Above the first tier and at the top of the heater, Fig. 2, noncorrosive distributors capable of rapidly heating the incoming water to steam temperatures went in. A cross-counterflow of steam and water takes place. The steam is that flashed from blowdown. Here, in what constitutes the first stage of deaeration, most of the entrained oxygen is removed (down to 0.1 to 0.2 ppm) so there is little oxygen to carry through to the trays below.

Such a design permits the three trays to serve largely in a mop-up capacity. Flashed steam from the integral blow-

down flash section passes through the second tier of trays on the first leg of its cross-counterflow with respect to makeup water. The third tier then delivers only pure uncontaminated steam, Fig. 2, to the downcoming deaerated water streams.

An external-design vent condenser—steel shell with admiralty B metal tubes—was selected since it can provide pure condensate for feed pump seals.

Blowdown Questions. Up to 35% of the 200,000-lb-per-hr boiler output, or 70,000 lb per hr, can go to blowdown and this flashes directly into the heater in a separate flashing compartment to avoid long, large steam pipes and large flash tanks. An exchanger attached to the heater shell, Fig. 2, cools the blowdown liquid drains while a steam separator within the flash chamber dries the recovered steam and passes it to the second of the three tiers of trays in the deaerator section.

Selected volume of deaerated-water storage is in line with operating experience at other similar plants.

Npsh requirements prompted rather special considerations. The standard approach involves elevating the heater storage compartment above the boiler feed pump to where it has enough head to avoid flashing in normal operation. A second choice resorts to subcooling or chilling the deaerated water below the control pressure - temperature relationship after it leaves the deaerator on its way to the pump, located at substantially grade elevation with the heater storage-tank outlet. Two subcoolers went into this design equipped with controls to reduce water conditions from 316 to 296 F at 20 psi. One of these coolers takes inlet water as a coolant. The second draws on an emergency source that automatically enters the secondary subcooler if the deaerated water temperature gets above a preset, danger limit.

Absolute economy in steam-condensing capacity in this instance had to go by the boards. Each heater, weighing 50,000-60,000 lb empty, plus piping, would have to be hoisted 50 ft in the air to provide flooded boiler-feed-pump suction. Obvious costs were further aggravated by a need for piling work in the low bearing soils of the area. The arrangement of Fig. 2 gave immediate savings of about $50,000.

This problem of assured boiler-feed-pump suction at all times is a severe one at higher pressures. And it becomes particularly so when large quantities of deaerated water are in equilibrium with high-pressure steam. A sudden loss of steam pressure and a large-scale steam-flashing occurs, binding the feed pump so seizing and costly pump damage result. (Internal flash preventers in the heater-storage compartment is a preferred solution to this problem.)

STEEL MILLS

Quite a different set of conditions prevailed when a 1,000,000-lb-per-hr 2-spray deaerating heater went into a Midwestern steel mill as a follow-up for a 1,000,000-lb-per-hr hot-process hot-zeolite plant for 650-psig boilers. Plant load fluctuates as high as 25% at infrequent intervals but each time load swing lasts from 5 to 10 minutes. Normal makeup runs somewhat less than 750,000 lb per hr.

Here is the picture the steel mill presents, Fig. 3. Incoming cold water from city mains passes through an external tubular vent condenser with a top temperature rise of 20 F at maximum load. It then sprays through a rosette of spring-loaded, self-adjusting, covered spray valves in a Sphericone hot-process unit. This heats water to within 2 F of steam operating conditions of 227 F and 5 psig, and removes over 95% of noncondensable gases in the water.

The now-heated raw water undergoes partial softening and silica reduction to 2 ppm with dolomitic lime. Precipitates separate out in a sludge bed featuring low upward rising rates that are continually decreasing to a minimum of 2.1 gpm per sq ft at the 1,000,000-lb-per-hr load. Effluent from this sphericone hot-process softener contains less than 5-ppm turbidity. It proceeds into a battery of six 10-ft-dia by 5-ft straight double-decked, hot, styrene-zeolite softeners where it is softened to zero hardness. When the water leaves this stage it is ready for deaerated heater processing and storage.

There were three possible arrangements, Fig. 4: Scheme A—thoroughfare hookup, providing maximum flow at low pressure of 5 psig in both heater and softener. Scheme B—stepwise hookup of heater at 40 psig and softener at 5 psig, requiring a separate, additional, 40-psig heater raising equipment investment and operating costs. Scheme C—vent condenser assembly employing an external tubular design on the deaerator for top temperature rise of 20 F on incoming water, followed by a vent condenser on the hot-process softener for an extra 20-F pickup. This pro-

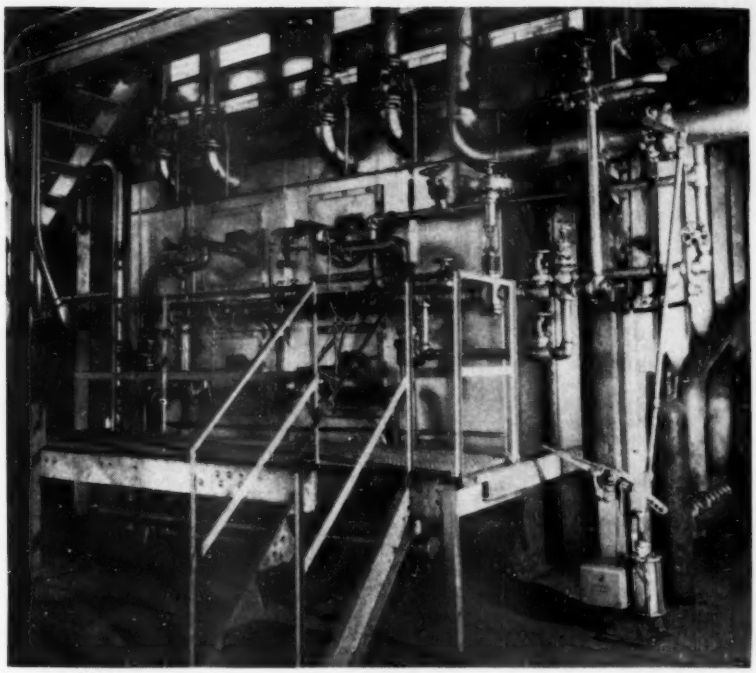
(*Continued on page* 198)

Design Characteristics of Modern Deaerating Heater

Type	*Steam to water flow*	*Vent Condenser* — *External tubular*	*Vent Condenser* — *Internal head*	*Incoming-water distribution*	*First-stage water heating*	*Second-stage deaeration*	*Steam-pressure drop, psi*	*Water pressure, psi*
Tray: Cross flow Parallel, Counter	Cross-counter, parallel, directly counter	U-tube or straight	Self-adjusting spray valves (with spray valves these tray heaters are spray-tray type) Fixed orifices in distribution pipe.	V-notched weir box plus distribution pans and trays. Fixed orifices in pipes plus distribution pans and trays. Spray valves and distribution pan	Heater trays Spray valves	Trays	0.1-0.3	Weir distributor—0.5 Spray valves—2.0 Fixed orifices—0.5-3.0
Spray	Countercurrent flows in two-stage steps. Parallel flow in second stage.	Same as above	Same as above	Self-adjusting spray valves. Fixed orifices in pipe	Spray valves	Scrubber or reboiler	0.3-0.6	2.0
Atomizing	Countercurrent flows in two-stage steps. Atomization in second stage.	Same as above	Same as above	Same as above	Spray valves	Steam-jet atomization with fixed or variable-area orifices	0.5-2.0	2.0

By **WM BRILL**, *Chief Engineer*
Colorado Fuel & Iron Corp
and
J F WHITE, *President*
The J F White Engineering Corp

When this steel plant found that steam capacity for half their processing needs would be condemned, they swung into action fast. Smart engineering located and moved a big straight-tube boiler some 500 miles to . . .



COMBINATION BURNERS in final installation use natural gas, coke gas, fuel oil

Replace 100,000 Lb per Hr in 17 Wk

► MINNEQUA WORKS of Colorado Fuel and Iron Corp processes about 600,000 tons of steel, nearly 50% of total capacity, through a blooming mill driven by a 15,000-hp McIntosh-Hemphill steam engine. Up to 1951, 15 Stirling boilers, installed about 1906 in East Mill plant, generated steam for this engine and other small mill processes. The blooming engine exhausts to atmosphere, so the boilers operate on 100% hot-process-softened makeup water.

During routine semiannual inspection in 1951, the insurance company's engineers discovered a serious increase in intercrystalline cracks in No. 8 boiler's steam drum. There were cracks as long as 54 in., extending halfway through the drum shells on eight of the 13 operating boilers. The insurance company would not issue any insurance for six units, and only conditional insurance for temporary operation of the other two boilers with cracks.

The mill was faced with both immediate loss of substantial rolling capacity and increased heating demands during the approaching winter. CF&I engineers diverted steam from B plant, on the other side of the mill, and started inquiries for the fastest possible way to replace the capacity just condemned.

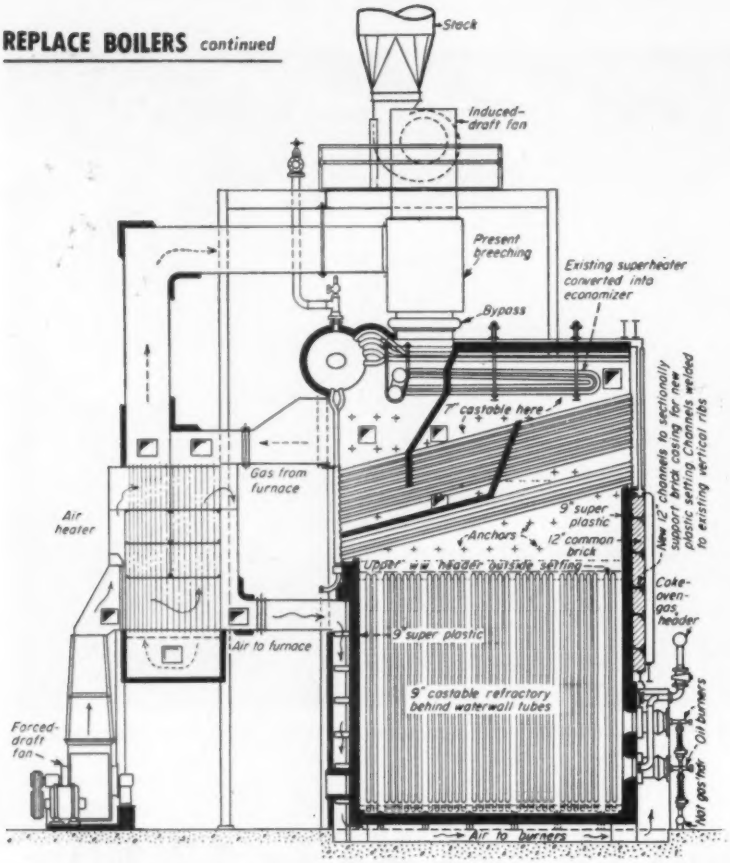
J F White Engineering Corp, of Denver, was then completing installation of a 15,000-kw turbine-generator in the mill power plant. Engineers from White joined forces with CF&I men to develop a plan for installing 100,000 lb per hr of used-boiler capacity. This would relieve the immediate shortage. Also, CF&I ordered two new 100,000 lb-per-hr units to modernize both East Mill and B plants.

Replacement Unit. Within two days after CF&I learned East Mill boilers would be condemned they asked White engineers to canvass the U.S. power industry for an available unit. In the idle Sinclair Refinery at Coffeyville, Kan., they located a Walsh-Weidner sectional-header boiler, with waterwalls and Foster-Wheeler superheater. After obtaining National Board inspection under *ASME Boiler Code*, they secured an option to buy this unit. It proved most suitable because:

(1) It could be dismantled immediately. (2) Straight-tube construction was most adaptable for rapid dismantling and reassembling. (3) It had a large furnace volume, as it was designed to burn acid sludge. (4) Superheater surface could be reused as an economizer. (5) It could be shipped in less than five days since it was on a branch of the AT&SF Railway, would require only one yard switching. (6) Inspectors had found it in virtually "as new" condition.

On Nov 6, 1951, CF&I accepted a lump-sum offer for engineering, design, dismantling, moving and re-erecting the boiler, complete with piping and auxiliaries. White personnel started dismantling operations the following day on a schedule of 9-hr days, 6-day weeks. Table I summarizes progress.

Before dismantling, White engineers marked pieces and checked controlling dimensions for re-erection. By carefully studying the construction, they found several procedures that saved considerable time in re-erection. Principally, they moved sectional headers and connected tubes as units. They field-cut the two connecting feeder and releaser tubes and a nipple to the mud drum. They cut waterwalls through the headers to fit railway clearances, and shipped the headers as units. Drawing at bottom of page 82 shows unit's arrangement, with arrows indicating tube cuts and field welds. Welders qualified under Section



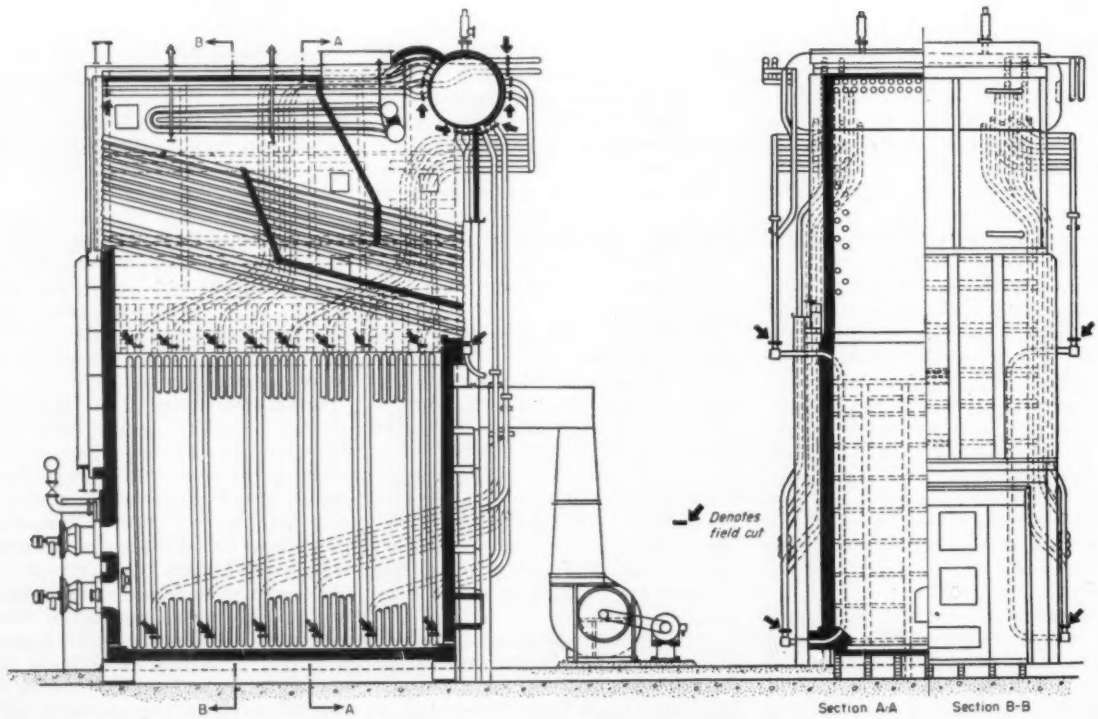
FINAL ARRANGEMENT of rebuilt sectional-header boiler. Redesigned unit now operates at 150 psig, uses former superheater as economizer, has air heater

IX, *ASME Power Boiler Code*, made all field welds on pressure parts.

Redesign. Meanwhile, engineers at White's Denver office were redesigning the unit, adapting it to the services required. Because of the boiler height, they had to raise four bays of the existing East Mill plant. They designed and detailed foundations and structural steel alterations; CF&I shops gave priority to the fabrication.

The original, suspended tile setting could not be salvaged, nor could new tile shapes be used because of delivery requirements. So White designed a completely new setting, arranged for air-cooled rear wall and floor instead of the original air-cooled side walls. The new setting, which uses plastic and castable refractories, is designed for full suspension. Where needed, new channels and angles were welded to the boiler structure for the suspension anchors and clips. This design permits replacing any section without disturbing the sections above.

Original design of rebuilt boiler was for 450 psig, 650 F. East Mill generates steam at 150 psig, saturated. By analyzing the tube surface and baffling, the engineers found that changing the gas path and using the superheater surface



FIELD CUTS on straight-tube boiler were made for easy shipping and reassembly. Engineers moved sectional headers and connected tubes as units, cut waterwalls through the headers to meet railway clearances. This saved re-erection time

Table I: Progress on Dismantling, Moving, Re-erecting the Boiler

Nov 1-3	Suitable unit located, examined; insurance company's inspection completed
Nov 6	Contract awarded. Construction equipment leaves Denver for Coffeyville, Kan.
Nov 11	Dismantling started at Sinclair Refinery, Coffeyville
Nov 7-30	Plastic refractory-setting design completed, engineering design on boiler burners and fans completed, fans located and purchased, miscellaneous boiler trim and fittings purchased
Dec 7	Dismantling completed and last of five railroad cars shipped
Dec 11	Induced-draft fan received on job
Jan 2	Instrument and control piping started
Jan 7	Pressure parts completed and tested, baffles and plastic refractory setting started
Jan 31	Power piping started
Feb 13	Insulation started on drum, ducts and breeching
Feb 19	Refractory setting completed, drying-out started
Mar 5	Unit cut into full service. Complete except for insulation
Mar 7	Platforms, walkways, building alterations completed
Mar 8	Final adjustment of combustion control completed
Apr 5	Insulation finished on boiler, auxiliaries and plant piping
Note	During above operations, CF&I removed three condemned Stirling boilers

as an economizer would develop desired capacity with proper auxiliaries. They left the surface in its original location in the hot pass (about 1500 F) between the first and second boiler passes, but tilted it to provide drainage. This design has performed outstandingly well, with no evidence of steam binding in the boiler circulation system. See Table II for performance figures.

Burners. Coke gas, natural gas and fuel oil are used at East Mill. Original burners in the replacement unit could not burn these fuels satisfactorily. So combination natural-gas, coke-gas and fuel-oil burners, together with new windboxes and structural front, were installed. (Photo, p 81)

Draft equipment was inadequate to handle the volumes necessary for the required capacity. White personnel located, in Baltimore, Md., an unused induced-draft fan with correct characteristics. They moved a temporary forced-draft fan from idle mill equipment. This has now been replaced with another in conjunction with a Riley Stoker Corp air heater to increase the unit's efficiency and capacity until the additional 100,000 lb-per-hr boiler is ready for service. Table III summarizes auxiliary equipment.

Construction went on without incident, and the boiler cut into the plant system on March 5, 1952, 17 weeks after date of contract. This period included time for complete dismantling and transporting to Pueblo, Colo., some 500 miles from Coffeyville, Kan. Unit has carried over 100,000 lb per hr on both natural and coke-oven gas. It was shut down and inspected during the recent steel strikes. Pressure parts and refractories have been troublefree.

Conventional boiler design would normally provide at least 25% more surface to develop capacity shown in Table II. This more efficient use of surface is largely due to the economizer being in the 1500-F zone, with consequent high temperature difference and improved heat transfer.

This installation shows what can be accomplished with idle equipment, in an emergency. The new boilers, ordered in November 1951, could not be scheduled for delivery until October and December 1952, many months after March 5, when the rebuilt unit was cut into full service for the first time.

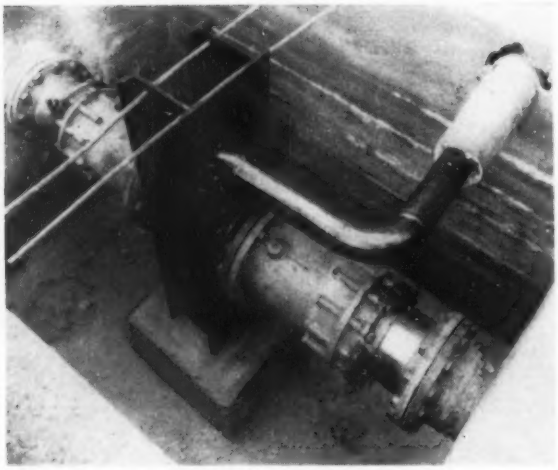
Table II: Performance of Rebuilt Unit

	Without air heater at two capacities (Observed)		*With future air heater (Predicted)*
Actual evaporation, lb/hr	30,000	100,000	100,000
Temp, gas to economizer (approx), F	—	1500	1500
Temp, water entering economizer, F	198	199	199
Temp, water leaving economizer, F	253	272	272
CO_2 in boiler exit gas, %	9.4	10.4	10.6
Temp, boiler exit gas, F	380	576	595
Temp, air-heater exit gas, F	—	—	400
Temp, ambient air, F	83	83	80
Temp, air leaving air heater, F	—	—	335
Draft loss through boiler, in.	0.00	0.98	1.20
Draft loss through air heater, in.	—	—	1.90
Draft loss through breeching, in.	0.00	0.40	0.50
Furnace draft, in.	0.17	0.32	1.10
Suction at induced-draft fan, in.	0.17	1.70	3.70
Air press. loss through air htr, in.	—	—	2.50
Air press. loss through ducts, in.	0.10	0.90	1.00
Air press. in windbox, in.	0.00	3.60	5.25
Static press. at f-d fan, in.	0.10	4.50	8.75
Furnace heat release/hr, Btu/cu ft	—	25,000	23,000
Over-all efficiency, %	85.6	73.9	82.3

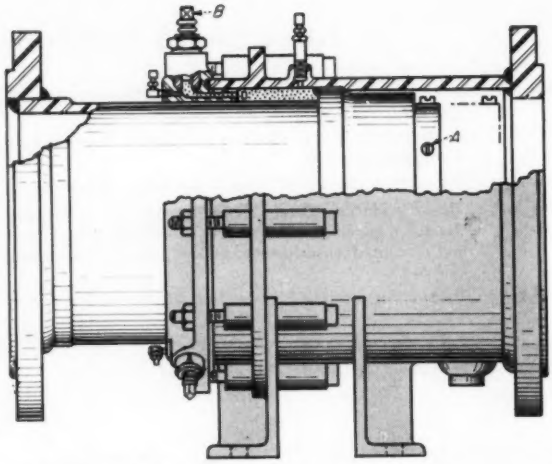
Note: Unit is rebuilt Walsh-Weidner sectional header boiler with waterwalls, Foster-Wheeler extended surface economizer, and future Riley Stoker air heater. Saturated-steam temperature is 360 to 378 F, operating pressure 150 to 175 psig, feedwater temperature 199 F. Fuel is natural gas at 985 Btu per cu ft.

Table III: Equipment Description

Boiler	Walsh-Weidner sectional header 525 psig
	Surfaces, Sq ft
	Boiler 6150
	Waterwall 1280
	Economizer (tubular) 630
	Total 8060
	(Table II data based on this total)
	Air heater, sq ft 9480 now being installed
	Furnace volume, cu ft 5570
Setting	A P Green *Kast-Set* side walls, *Super-Plastic* front and rear walls. Fully suspended setting designed by J F White Engrg Corp
Burners	Peabody Engrg Corp Type A-20 forced-draft burners with coke-oven gas ring; center-fired natural-gas gun and steam-atomizing oil burners
I-d fan	Buffalo Forge Co No. 8½ SSLD induced-draft fan direct-connected to 1200-rpm 75-hp motor
F-d fan	Buffalo Forge Co No. 8 SCLD forced-draft fan, belt-driven from 900-rpm 75-hp motor



1 Two 10-in. gun-packed slip-type expansion joints in steam distribution system. Note anchor for 4-in. service line



2 Single-end, flanged, gun-packed expansion joint can be repacked while at line pressure; uses semi-plastic packing

How to Plan and Engineer Your Piping

Slip-type expansion joints have many uses in modern piping systems conveying materials at elevated temperatures. Here are selection and application pointers that will save your time. Use them on your next design job for dependable results

By A L AICHER, *Mechanical Engineer, Yarnall-Waring Company*

► To ABSORB EXPANSION of pipelines conveying hot fluids you can use (1) loops or bends (2) corrugated or bellows-type expansion joints or (3) slip-type expansion joints.

Loops or bends are good above ground and where there is enough space for them. Little maintenance is needed, but they are expensive to form and install, especially in larger sizes.

Corrugated joint is a bellows or accordion-like section that flexes as pipe expands or contracts. Needing little space and maintenance, it is best where temperature changes are infrequent because then there is less flexing.

Slip joints have a sleeve that slides in a body fitted with a stuffing box to prevent leakage. They are simple and durable. Space needed is less than for a loop, and first and installation costs are lower, especially for large sizes. There is no danger of fatigue failure. Packing maintenance and lubrication of joint vary with service. Large traverses are accommodated—up to 12 in. by single-end joints, 24 in. by double-end.

Joint Design. All-steel joints with seamless-steel sleeve and body have definite advantages for moderate to high temperatures and pressures. Among these are low pressure drop through joint, uniform cross sections that equalize stresses, freedom from leaks, light weight, small clearances, and easy fabrication of special anchor bases and service outlets for specific job requirements.

Internal limit stops, *A* in Fig. 2, prevent sleeve from pulling out of body if an anchor fails. Unlike outside tie rods, they cannot be incorrectly set in the field.

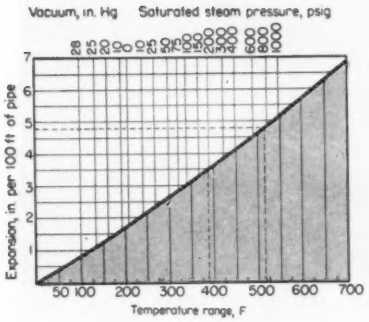
Repacking. Joint in Fig. 2 is gun-packed type. Fresh packing can be added to stuffing box while joint is under full line pressure. Guns built into gland force semi-plastic packing slugs into stuffing box. When stuffing box leaks all that need be done is add packing slugs until leak stops.

Deflector vanes, Fig. 2, distribute packing evenly around box. They also act as check valves to prevent back flow when plunger is removed and another slug is inserted.

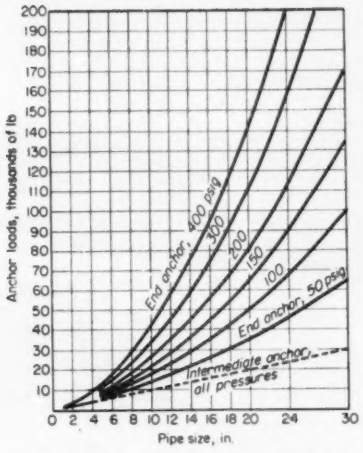
Slip-joint sizes range from 1 to 30 in. Gun-packed units take temperatures to about 650 F. Conventional gland-packed design is used for higher temperatures.

Traverse Selection. Sleeve movement needed for a given temperature range depends on pipe material and length. Fig. 3 shows steel-pipe expansion in inches per 100 feet for various temperature ranges.

When determining temperature range for outdoor lines be careful to consider

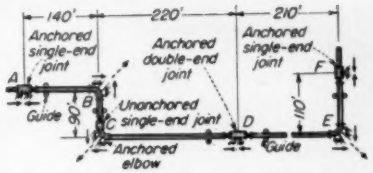


3 Chart, to find expansion of steel pipe conveying steam, saves you time



4 Find loads on end and intermediate anchors for pipes from this chart

Wise Choice of Slip Joints Insures Good Operation of Your Piping Systems for All Power and Industrial Jobs



5 Typical applications of slip joints in a piping system conveying steam

Systems Using Slip Expansion Joints

the possibility of subzero temperatures during winter. Where installation temperature is higher than minimum expected, push sleeve in about ¼ in. for each 33 F between installation and minimum temperatures.

Installation. Single-end joints have a sliding sleeve on only one end of body, and are furnished with or without anchor bases. Double-end joints have sleeves on both ends, and are furnished with anchor bases. They must always be anchored so that each sleeve can take care of the pipe expansion in its own direction.

Highly polished chromium surfaces are best for sliding sleeves. Protect exposed surfaces with a dust cover. Provide enough space around joint to allow lubrication and packing. Use a steam trap to remove condensate as fast as it forms in body. Connect to drain opening at lowest point in body.

Anchor Loads. Intermediate anchors in straight sections of pipe must carry friction load of joint sleeve in packing box, plus friction in pipe hangers, supports and alignment guides. End-of-line anchors carry an additional load equal to the product of line pressure and internal pipe area.

Fig. 4 shows approximate loads on end and intermediate anchors in systems using slip joints.

Guides. Alignment guides are needed near expansion joints to align sleeve properly and insure its free movement through stuffing box. Table gives recommended guide spacing.

System Design. Fig. 5 shows typical applications of slip-type joints in a piping system. The 8-in. line carries 125-psig steam with 25-F superheat. Minimum temperature is zero F. Procedure for finding traverses, anchor loads and alignment-guide locations is as follows.

Saturation temperature for 125-psig steam is about 355 F, Fig. 3. Add 25 F for a total temperature range of 380 F. Expansion from Fig. 3 is 3.4 in. per 100 ft of pipe for a 380-F range.

Span AB = 140 ft; expansion = (1.4) (3.4) = 4.8 in. Single-end joint with 8-in. traverse is suitable at A. Span BC is 90 ft, has an expansion of 3.1 in. Joint at C is single-end with a 4-in. traverse. Span CD is 220 ft, expansion 7.5 in. Span DE is 210 ft, expansion 7.2 in. Joint at D is double-end with an 8-in. traverse for each end. Span EF is 110 ft, expansion 3.7 in. Single-end joint with 4-in. traverse is suitable.

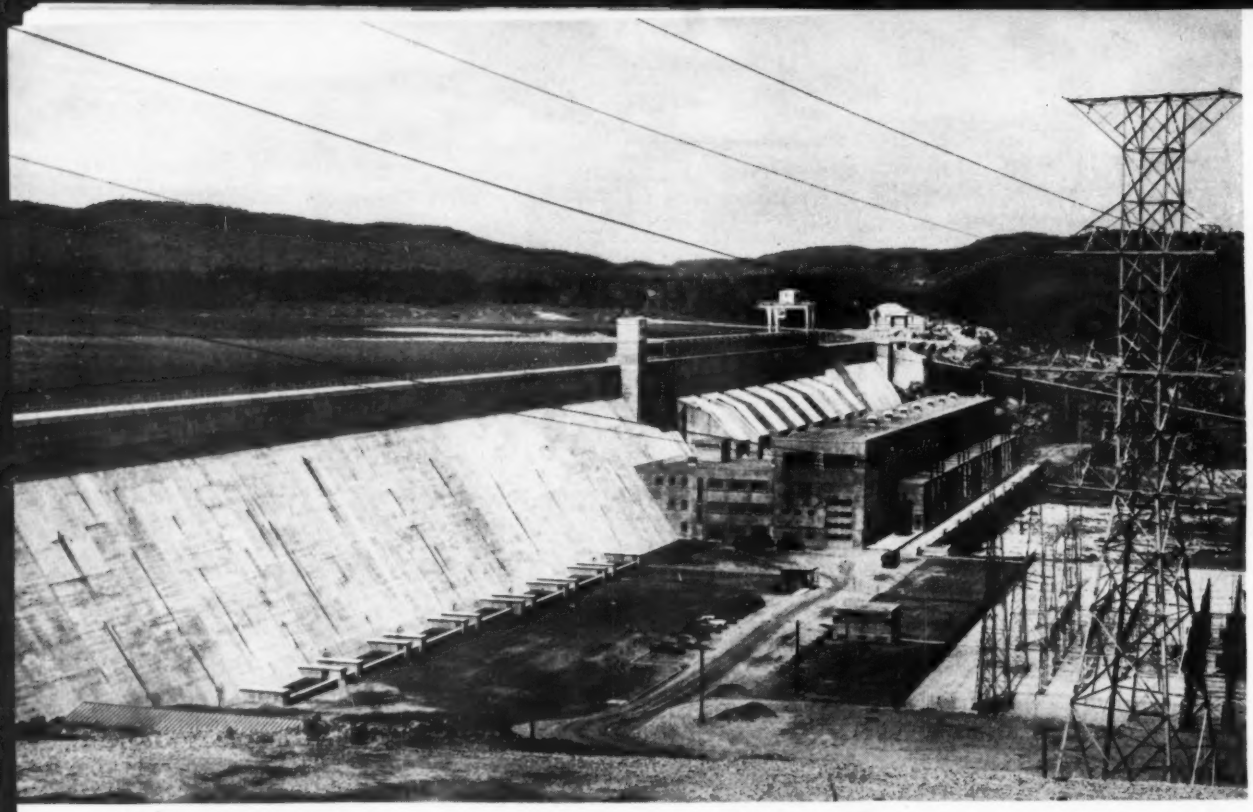
Anchor Loads. Intermediate anchors at A, D and F are subject to possible maximum loads of 8000 lb in both directions. Values are obtained from Fig. 4 for 8-in. pipe. Contraction loads equal expansion loads, but are in opposite direction.

End anchors at B, C and E have possible maximum loads of 15,000 lb, solid arrows Fig. 5. These loads have a resultant of 21,200 lb acting along an axis at 45 deg with pipe axis, dotted arrows Fig. 5. Contraction loads in reverse direction consist of friction only. Friction loads are 8000 lb along solid arrows, with an 11,300-lb resultant.

Alignment. Place guides within 18 ft of sleeve ends of expansion joints, as indicated in Fig. 5. Recommended distance is found from table. Note in this case distance for gland-packed joint is half that for gun-packed, or 9 ft.

Guide and Support Spacing

Nominal pipe size, in.	Distance between guide & joint, ft — Packing type — Gun	Gland	Distance between guides, ft
1½	8	5	10
2	10	5	13
2½	11	6	15
3	12	6	19
3½	13	7	22
4	14	7	25
5	15	8	30
6	16	8	35
8	18	9	45
10	20	9	60
12	21	10	70
14	22	10	80
16	23	11	90
18	24	11	100
20	25	12	105
24	26	12	110



DES JOACHIMS PROJECT, one of three built on Ottawa River by Hydro-Electric Power Commission of Ontario, runs with 135-ft head. Has total capacity of 496,000 hp installed in eight 62,000-hp francis turbines turning at 105.9-rpm speed

Design Features of Three Canadian

Here are factors that influenced turbine selection for three hydro plants with 40, 77 and 135 ft heads and total capacity of 900,000 hp. Authors discuss reason for using oil-lubricated guide bearings, different bearing designs and shaft water seals*

By **A E AEBERLI,** *Mechanical Engineer*
and **G F SIMSON,** *Electrical Engineer*
Generation Dept, Hydro-Electric Power Commission of Ontario

► FROM THE NORTHERN END of Lake Temiskaming to Point Fortune, 22 miles above Montreal Island, the distance is 450 miles. Here the Ottawa River forms the boundary between the provinces of Ontario and Quebec, Canada. On the upper section of this river the Hydro-Electric Power Commission of Ontario is developing three large power sites.

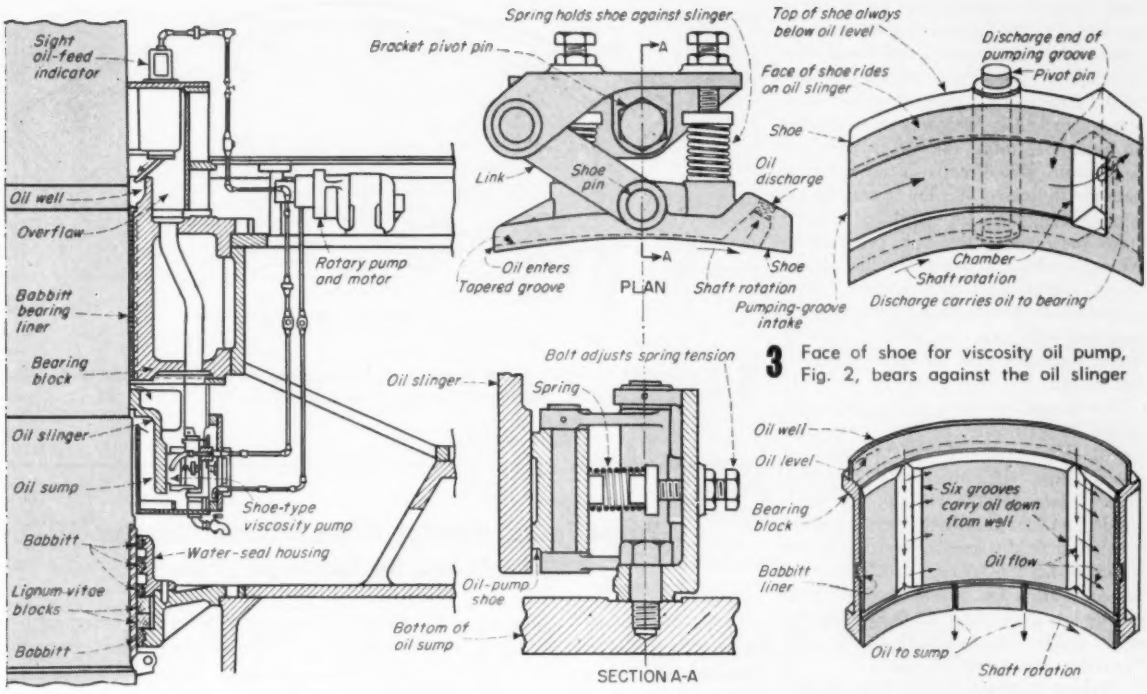
Three Plants. About 33 miles below the outlet of Lake Temiskaming, La Cave development was completed in 1952. It has a capacity of 264,000 hp in eight 33,000-hp units, to operate under a 77-ft head. Des Joachims, 60 miles down river from La Cave, is the largest of the three plants. It has 135-ft head, eight 62,000-hp units for a total capacity of 496,000 hp and is now in full operation. Chenaux, about 11 miles above Renfrew, Ont., has the relatively low head of 40 ft, eight 21,000-hp units or a total capacity of 168,000 hp. All eight units are now in full operation.

Water Storage. Upstream from La Cave several water-storage basins with 5,000,000 acre-ft capacity regulate the river flow. One of these basins, Lake Temiskaming, when drawn down to low levels will reduce the head at La Cave slightly. But generally at all three plants forebay levels will be controlled for daily pondage needs.

Turbine-Selection Factors. Range in heads, 77, 135 and 40 ft, afforded an interesting selection of turbines. For heads between 60 and 90 ft a choice can be made of high-speed propeller and the slower-speed francis types. To make the selection requires a study of: (1) cost for equipment (2) substructures (3) excavation (4) crane capacity. In addition, reliability, maintenance costs and kilowatt-hours output for the different types of turbines have to be evaluated. When selecting the turbines other factors must also be considered, such as:

1. Adjustable-blade propeller (kaplan) turbines have over 80% efficiency at loads above 25%. This efficiency can be had with fixed-blade propeller turbines at loads above 70%, and from

*Abstracted from paper presented before American Institute of Electrical Engineers at meeting in Toronto, Ontario, Canada.



1 Section through turbine bearing and water seal on the La Cave units 1-4

2 Details of shoe-type viscosity-oil pump installed on La Cave units 1-4

3 Face of shoe for viscosity oil pump, Fig. 2, bears against the oil slinger

4 Section of guide bearing shows oil-distribution grooves, La Cave units

Hydroelectric Projects Analyzed

francis type above 50% load. Kaplan turbines have their best efficiency at about 60% load. But, in plants that have several units, high efficiency can be maintained by adjusting the load on a number of units and starting and stopping machines as load requires. This can be readily done by automatic start-stop governors and synchronizing equipment operated from the control room.

The kaplan turbines' advantage of high efficiency over a wide range of loads is largely discounted in a group of plants having several units. This is the experience in Chats Falls plant, 30 miles below Chenaux, which went into service in 1932 with eight fixed-blade propeller turbines. In spite of the units' peaked efficiency curves, over-all plant efficiency is high.

2. Kaplan and propeller turbines have a decided advantage over francis runners in the size of their water passages and higher speed. The latter reduces generator cost. Since kaplan turbines have more moving parts than a francis or propeller runner, they may be out of service longer for maintenance.

3. As specific speed of the runner is increased the turbine must be set lower to prevent cavitation. This increases the cost of excavation and draft tubes. Advantages here rest with the francis turbine as it can be set higher above tail-water level without serious runner pitting.

4. At the plants discussed, heads will be reduced during spring floods because of increased tailwater level and maybe forebay level will be reduced. Reduced head decreases output of francis turbine more than kaplan or propeller types. But a seasonal load reduction on the Southern Ontario system usually occurs during flood period on the Ottawa River. So, reduction in head on the plants due to floods was not important when selecting the turbines.

Choice of turbines was based on a careful evaluation of these and other factors. For the La Cave 77-ft-head plant, choice was between francis and propeller turbines of either fixed or adjustable-blade types. Francis turbines were chosen. Under 135-ft head at Des Joachims, francis turbines were a natural choice, even though the kaplan was considered. Choice for the 40-ft-head Chenaux lay between fixed-blade propeller units and kaplan automatically adjustable-blade type. Fixed-blade propeller turbines were selected as best suited to power-system conditions.

Difference in unit capacity at the three plants is due largely to the difference in head. There is not a wide difference in physical size and weight, and all turbines may be considered of large size. Table, p 88, gives main physical features.

Water Passages. Chenaux and La Cave turbines have reinforced concrete scroll cases. Three passages formed in the concrete as part of the scroll case conducts water from the forebay to the Chenaux turbines. Two passages do a like service on La Cave units. Low pressure on the Chenaux casing permitted using partial speed rings. These have separate steel stay vanes bolted to a top cast-steel ring. Lower end of each vane is cast in concrete and arranged to carry load from top to bottom of the scroll case.

At La Cave the higher pressures, 77-ft head, required complete cast-steel speed rings with separate stay vanes bolted to upper and lower rings. In

both plants the speed rings are securely anchored to the reinforcing in the concrete forming the scroll cases and substructures. The higher turbine settings of the francis units above tailwater level kept scroll-case pressures low enough to permit forming the water passages and scroll cases directly in the concrete. Studies indicated the lower setting required for propeller turbines would have increased scroll-case pressure to where steel-plate penstocks and scroll cases would be required with their added cost. For these reasons, francis turbines with concrete scroll cases and water passages gave the most economical design.

Scroll-case pressures at Des Joachims made it desirable to use steel-plate scroll cases, triple-riveted to cast-steel speed rings. Circumferential joint between plates of the casings are field-welded, and longitudinal joints are shop-welded or field-riveted. Scroll cases are designed for 165-ft head, which includes an allowance for pressure rise. Penstocks are steel plate, 22 ft in diameter with welded longitudinal seams and riveted circumferential joints.

Turbine Runners. At all three plants, turbine runners are cast steel, double heat-treated to insure proper grain refinement throughout. Shafts are forged to meet special requirements as to reduction in forging and heat treatment. Exposed parts of each shaft are machined and polished to a finish of about 63 microinches. The guide bearing journals are machined and polished to a finish of 16 microinches or less.

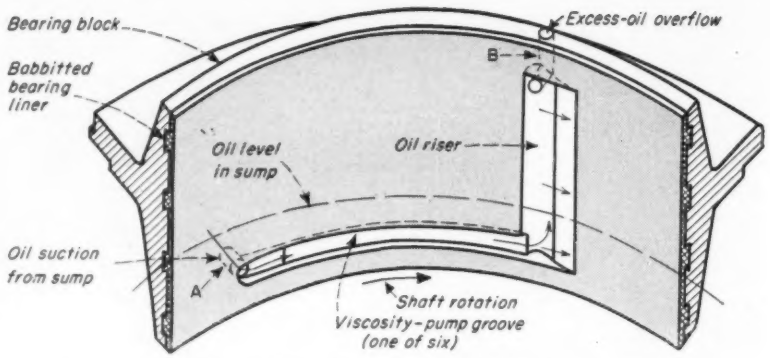
Turbine Bearings. There has been a recent trend toward oil-lubricated babbitt bearings for hydraulic turbines. Earlier turbines were generally installed in open flumes and the bearings were of necessity water lubricated. Lignum-vitae blocks, generally used, became standard equipment even on modern vertical-shaft units with reinforced-concrete or steel-plate spiral scroll cases with a head cover. Turbine bearing is close to the head cover and might be flooded if water pressure develops above crown of runner. Water-lubricated bearings made it unnecessary to worry about water getting into the oil.

As turbine and generator sizes increased it became difficult to keep lignum-vitae bearings adjusted to insure turbine and generator parts running true. Therefore it was desirable to use oil-lubricated bearings that could be adjusted to close tolerances. Sealing arrangements to prevent water leaking into these bearings have been developed so oil-lubricated guide bearings are today accepted as a necessary part of hydraulic turbine equipment.

Oil Lubrication. It is interesting to see how this trend toward oil-lubricated guide bearing has taken place on hydraulic turbines installed by the Hydro-Electric Power Commission of Ontario. During the 35 years before 1948 the Commission built 18 hydroelectric plants with 55 vertical shaft units of about 1,300,000-hp total capacity. Only two of these had babbitt bearings and they were installed about 25 years ago. All other turbines, put into operation, have water-lubricated lignum-vitae bearings.

Since that time 34 vertical-shaft units have been installed, including La Cave, totaling about 1,200,000 hp in seven plants. Of these only six units of 144,000-hp total capacity have water-lubricated lignum-vitae bearings. The other 28 have oil-lubricated babbitt bearings.

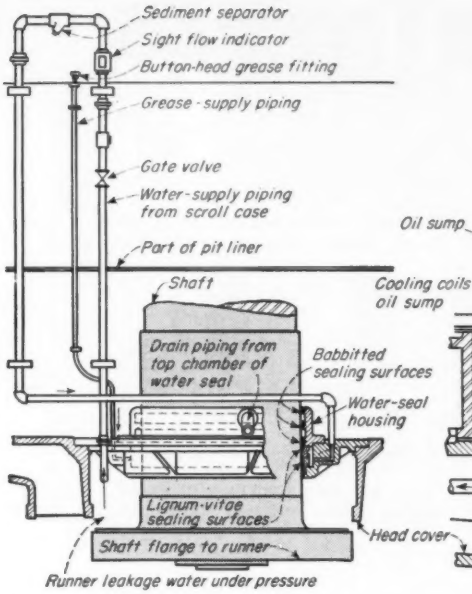
Guide-Bearing Designs. These turbine guide bearings are precision-bored, babbitt-lined, oil-lubricated, but two differ-



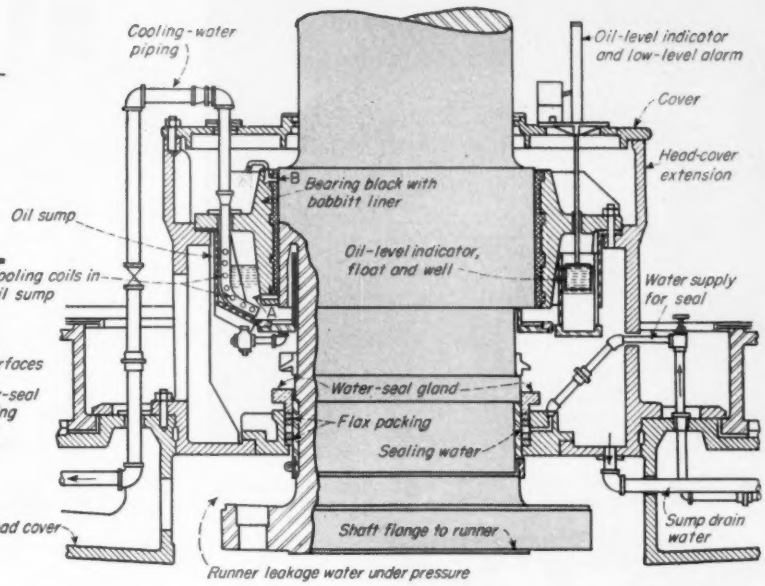
5 Segment of turbine's guide bearing shows viscosity-oil pump, oil riser and overflow pipe at Des Joachims, Chenaux, and on units No. 5 to 8 at La Cave

Principal Features, Dimensions, Weights of Turbines, Generators Installed at La Cave, Des Joachims and Chenaux

	La Cave		Des Joachims	Chenaux
	Units 1 to 4	Units 5 to 8	8 Units	8 Units
Turbine Features				
Manufacturer	Canadian Allis-Chalmers	John Inglis	Dominion Engineering	Dominion Engineering
Type	Francis	Francis	Francis	Fixed-blade propeller
Design head, ft	77	77	130	40
Capacity, hp	33,000	33,000	62,000	21,000
Speed, rpm	94.7	94.7	105.9	94.7
Specific speed, Ns	75	75	60	137
Rated discharge, cfs	4500	4500	5000	5000
Runner discharge dia, ft	14.6	16.25	14.5	17.1
Guide-vane circle dia, ft	16.2	18.5	16.3	20.2
Guide-vane height, ft	5.1	4.75	4.0	7.3
Runner vanes, number	17	13	17 & 15	6
Guide vanes, number	20	28	20	20
Stay vanes, number	10	14	10	10
Shaft diameter, in.	30	30	35	25
Water thrust on runner, lb	300,000	330,000	270,000	583,000
Weight rotating parts, lb	153,000	143,000	160,000	93,000
Weight of turbine equipment, one unit, lb	570,000	550,000	815,000	635,000
Scroll case	Concrete	Concrete	Plate steel	Concrete
Generator Features				
Manufacturer	Canadian Westinghouse	Canadian Westinghouse	Canadian Westinghouse	Canadian General Electric
Capacity, kva	27,000	27,000	50,000	17,000
Power factor	0.95	0.95	0.90	0.90
Voltage, kv	13.8	13.8	13.8	13.8
Rotor diameter, in.	319.5	319.5	316.9	270.4
Air-casing, inches square	432	432	432	392
Air-casing, height, in.	110	110	139	69
Rotor weight, lb	370,000	370,000	550,000	303,000
Generator weight, lb	802,000	802,000	1,100,000	625,000
Machine total weight, lb	1,372,000	1,352,000	1,915,000	1,260,000



6 Turbine shafts, La Cave units 1-4 have babbitted and lignum-vitae sealing surfaces combined with annular grooves



7 Des Joachims turbines guide-bearing-and-shaft water seal uses flax packing. At Chenaux, carbon rings act as seals

ent types are used. Des Joachims design is similar to that at Chenaux, and on units No. 5 to 8 at La Cave. For La Cave units No. 1 to 4, Fig. 1 shows the general arrangement of the guide bearings and oil pumps.

An annular oil sump below the bearing surrounds the turbine shaft. A specially designed oil slinger connects to the shaft with a shoe-type viscosity-oil pump rubbing against the slinger. This pump is mounted in the oil sump so it is always below minimum oil level. Oil discharges from the pump to a small reservoir above the bearing. Leaving this reservoir, oil goes to an annular distributing well formed in the top of bearing block.

Oil, flowing by gravity down through the bearing, is carried to all parts of it by a network of vertical and horizontal grooves. Fig. 2 and 3 show details of the oil slinger and viscosity pump, while Fig. 4 gives the oil grooves in the guide bearing. Oil, discharging from the bottom end of the bearing, passes down over the oil slinger and goes to the sump. An automatic motor-driven rotary pump supplies oil to the bearing when starting the unit, or as standby should the viscosity pump fail.

Other Bearing Designs. Units No. 5 to 8 at La Cave and all units in Chenaux and Des Joachims have different guide-bearing arrangements. Machined horizontally around the bearing below minimum oil level in the sump, a series of six special grooves acting as viscosity pumps supply oil to the Des Joachims guide bearings, Fig. 5 and 7. Oil enters the viscosity pump grooves at the deep end by holes *A* drilled through the bearing block. Each pump groove leads to a specially shaped vertical one that acts as a riser to distribute oil to the bearing surface. Excess oil discharges to top of bearing block through a hole *B* in top of each riser and returns to the sump.

Cooling coils in the sumps keep oil viscosity at a correct value and prevent overheating. On Units No. 5 to 8 at La Cave, bearing blocks are cored to form internal coolant passages, so cooling coils are not required in the sump. Water circulates under pressure through the coils and passages. Units No. 1 to 4 at La Cave do not have a cooling coil in the oil sumps.

Water Seals. Below the guide bearing of each unit a water seal or stuffing box prevents oil loss to the tailrace or mixing of leakage water from above the runner with oil in the bearing. The seal has annual grooves that drain away any water that may rise through the clearances between the turbine shaft and the grease- or water-lubricated sealing surfaces. At La Cave, units No. 1 to 4 have babbitted and lignum-vitae sealing surfaces, Fig. 1 and 6. Sealing surfaces at Des Joachims are flax packing, Fig. 7. Carbon rings are used for sealing at Chenaux and for unit No. 5 to 8 at La Cave.

All turbine bearings other than that on the main shaft have high-pressure grease fittings, lubricated from a portable grease compressor.

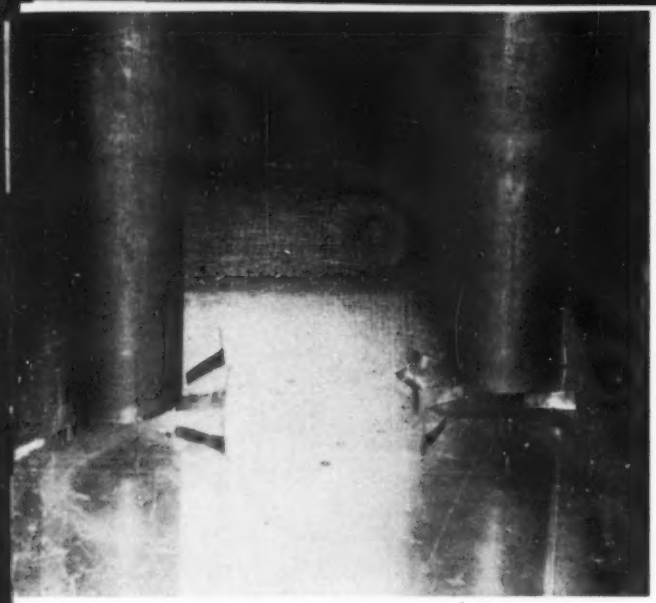
Generators. At Des Joachims and Chenaux, rated generator capacity conforms to turbine capacity at rated head. La Cave operates at a head about 6% above the normal on which turbine rating is based during the season of large water storage. For this reason generator ratings were based on turbine output at maximum head.

At all three plants the generators are totally enclosed, ventilating air being circulated through air- to water-heat exchangers, mounted within the enclosing housing. The housings are square and have dampers so part of the air may be circulated in the powerhouse for winter heating. Totally enclosed units were selected to (1) reduce cost of cleaning machine windings (2) reduce noise (3) have a cooler powerhouse in summer.

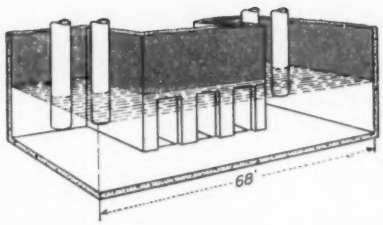
At Chenaux each generator sets in the substructure so only part of the bridge upper bracket and the exciter extends above the main floor. Stator is in a square recess in the foundation with cover plates at the main floor to complete the enclosure. Des Joachims and La Cave generator casings are above the main floor. Because of the francis-turbine settings and deeper stator frames, the limit to which the latter could be depressed would still have left a large part of the air casing exposed.

Sprinkler rings are installed in all

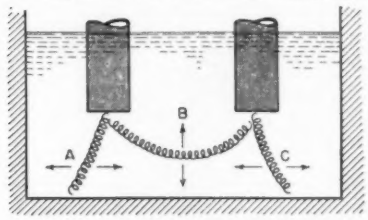
(*Continued on page* 204)



1 Model of pump intake has flow-indicating flags mounted on transparent Lucite floor. They can be seen from below



2 Proposed installation of prototype before model tests were conducted



3 Types of vortex formation at model suction bell. Prototype is similar

Rid Vertical-Pump Intake Design of

Field experience with intake models shows you can study an entire installation in miniature and obtain results that will hold for the prototype. Here are details of several actual tests, their results, and the design thinking that was developed from them

By A BRKICH, *Development Engineer, Cameron Engrg Dept, Ingersoll-Rand Co*

► CHANNELS GUIDING WATER to vertical pumps greatly affect their performance and dependability. Single-pump intakes are relatively simple. But multi-pump installations need considerable thought during intake design, especially where capacity of existing facilities is increased by inserting more pumps into a given space.

Intake studies must be reasonably accurate because construction expense is great. Savings made by over-simplification of the intake can hardly be justified if they produce harmful hydraulic conditions that increase frequency of pump repairs. Best, if not the only way of predicting installation performance, is duplication with a model. Cost is justified by assurance of successful operation of the full-size installation.

Suction Conditions. Good operation requires that flow in suction bell be evenly distributed across inlet area. This is obtained only by proper design of components influencing it. One of the most important is the flow pattern.

Poor flow can lead to hydraulic instability at suction bell in form of a strong vortex that tends to wander in a periodic manner, causing varying pressure distribution with uneven flow to impeller. Outward signs are vibration, cavitation, worn bearings and others. These may be continuous or periodic, depending on disturbance. In severe cases pump column bolts fail, probably from fatigue.

Another form of hydraulic unbalance occurs when high channel velocities or obstructions cause flow to enter only one side of bell. Disturbance is usually of constant magnitude but effects are as bad as those above.

Model Tests. You can consider channel flow pattern the result of two independent influences. One is pattern established by flow from channel inlet to pumps. Superimposed on it are local vortices induced about each pump by impeller rotation. Channel flow is the most important in hydraulic-stability studies and deserves much consideration.

Sharp corners, abrupt turns and nonsymmetry cause channel-flow disturbances. In model tests we can replace pumps with pipes having suitably shaped inlets, and obtain reliable results.

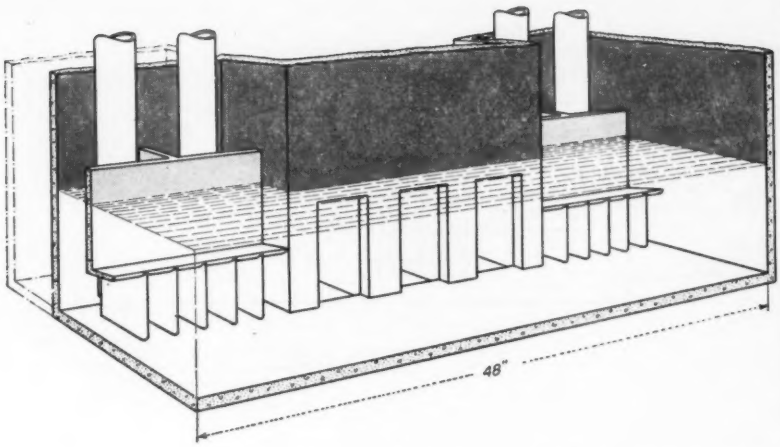
Intake Problem. Hydraulic losses are never a consideration because velocities in intake are low. Prevention of eddies and vortices in channel that disturb flow at inlet bell is the problem to solve. You may do this by changing channel design to eliminate disturbances or by isolating them in areas where they do no harm.

Scale factors from 1/12 to 1/16 give models of convenient size. They permit easy reproduction of construction details with a flow pattern large enough to be clearly evident.

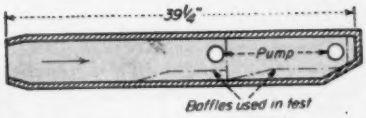
Model capacity to use is debatable. For exact hydraulic similarity, forces acting on elements at similar points in the two flows must have the same ratio to each other. Reynolds number compares inertia and friction forces, or $R =$ inertia forces/friction forces $= VL/u$, and $Q_m = Q(L_m/L)\ (u_m/u)$, where $Q =$ flow capacity, $L =$ characteristic length, $u =$ kinematic viscosity, $m =$ values pertaining to model, $V =$ characteristic velocity.

Froude number compares inertia and gravity forces, or $F =$ inertia forces/gravity forces $= (V^2/L)/g$, and $Q_m = Q(L_m/L)^{5/2}$, where $g =$ acceleration due to gravity.

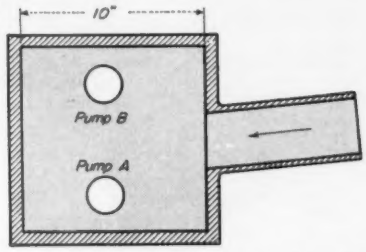
Since viscous or frictional forces are



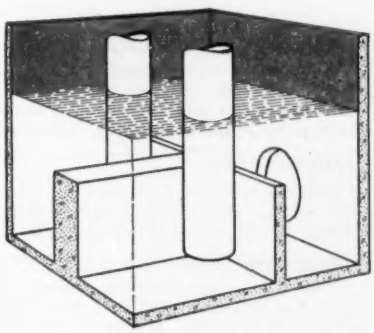
4 Final model arrangement of proposed setup shown in Feg. 2. Model tests reveal troubles that would be met with first design if it were built as originally planned



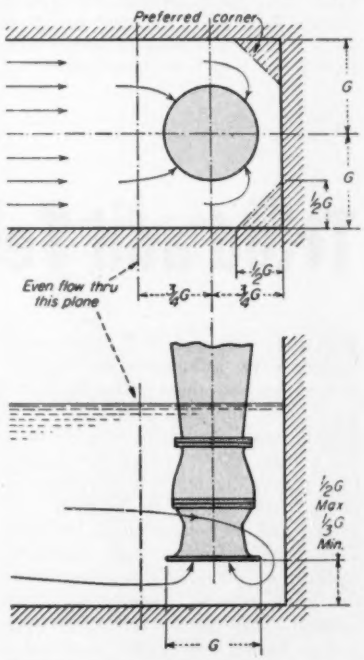
5 Arrangement for second model test described in the text of this article



6 Original arrangement of the third model test that was made by author



7 Corrected arrangement of intake in Fig. 6. Model tests showed faults



8 Preferred installation for one pump when intake model tests aren't made

Guess With Model Tests

secondary in these studies, Reynolds number is usually ignored. Froude number is essentially an expression for centrifugal forces for an element traveling in a curved path. So with a model operating at Q_m, any vortices present are dynamically like those in prototype, particularly if water surface is free.

Model capacity is increased slightly to compensate for stabilizing effect of its smaller dimensions. If channel design is correct, velocities can be substantially increased without disturbing flow if other limitations like hydraulic jump are not exceeded.

Flow Indicators. Small metallic flags, made of 0.005 in. brass shim stock mounted about suction bell, make good flow indicators in model having a Lucite floor, Fig. 1. By observing flow from below model with mirrors, pattern is clearly evident. Total angular movement and direction of any flag permit a more exact evaluation of flow stability at any point. Photographs are easily taken.

Test Examples. Fig. 2 is an installation difficult to analyze without a model. Four large pumps were to be used in a new building—two in each bay. Lack of space caused a crowded arrangement.

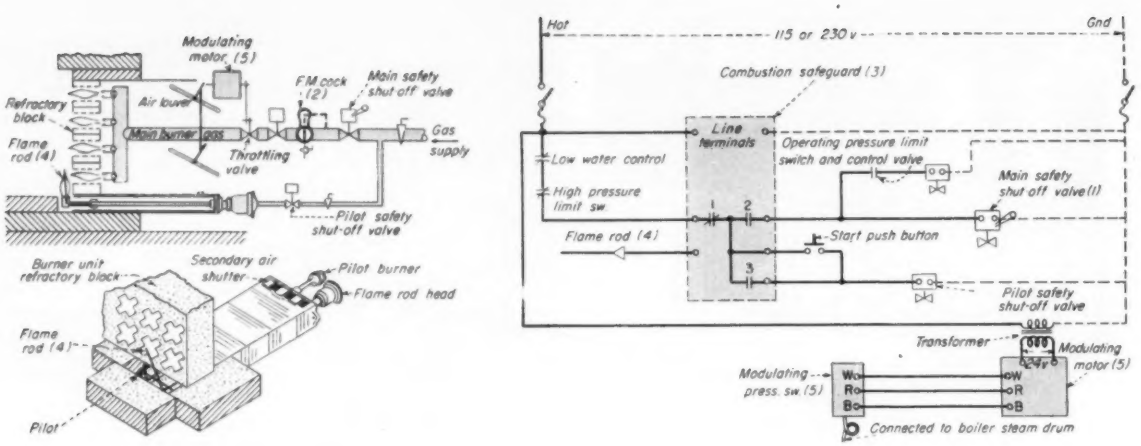
Model tests immediately showed that the large quantity of water emerging from the sluice gates impinged against the facing wall, creating a strong flow distortion. Abrupt 90-deg turn ahead of pumps aggravated this condition. Average velocities around pumps appeared low, but lack of guides allowed disturbances to reach pumps and set up vortices. Fig. 3 shows vortices observed during tests with various combinations of pumps and sluice gates.

With Froude number same as in prototype, vortices were not persistent. But they had the objectionable feature of wandering appreciably. Because of high bell clearances and large area behind them, rotating bodies of water under pumps with vortices *A* and *C* moved about whenever disturbing influences from the sluice gates reached them. This would cause hydraulic unbalance of impellers in prototype. Resulting vibration reduces pump operating life. Water surface gave no sign of conditions below.

At increased capacities, vortices became more positive, showing flow pattern was unsound, needed correction. Rearrangement showed improvement was made by bringing wall behind pump forward until there was a clearance of one-fourth suction-bell diameter with pumps one-half a bell diameter above floor. Magnitude of vortices *A* and *C* was reduced while holding them firmly in position under the bells. Vortex *B* was eliminated entirely.

Fig. 4 shows final arrangement. It has a flow pattern completely different from the original. Front wall prevents disturbances from reaching pumps. Tunnels with their sloping ceilings

(*Continued on page* 192)



By selecting recommended automatic-lighting devices and sequences you feel sure you're getting

MAIN GAS SAFETY SHUTOFF VALVE

Avoid using an automatic-opening, automatic-closing safety shutoff valve with the replaceable flame rod and pilot unit shown above. Reason is that lighter-torch flame-contacting rod within the housing would automatically admit unburned gas.

SAMPLING COCK

Approved sampling cock (No. 2, above) for leakage test of main safety shutoff valve located downstream of safety shutoff. Connected with ¼-in. OD copper tubing.

COMBUSTION SAFEGUARD

Contact 1 is safe-start relay contact, and must be closed if safety shutoff valves are to open. After start pushbutton is pushed and a torch is inserted to light the pilot, pilot flame contacts the flame rod causing flame relay contacts 2 and 3 to close, and completing circuit to pilot safety shutoff valve and main safety shutoff valve. After start pushbutton is released and as long as pilot flame contacts flame rod, pilot safety shutoff valve remains open. Main safety shutoff valve must be opened manually. Flame relay contacts 2 and 3 open on flame failure. See No. 3, drawing, right.

FLAME ROD

Located so pilot flame contacts it only where pilot will reliably ignite the main burner. No. 4, in the drawing, left, above.

MODULATING MOTOR

This motor, No. 5, above, controlled by a modulating pressure switch, adjusts the firing rate in response to steam demand by means of linkages operating gas throttling valve and burner air louvers. In closing, the throttling valve travel is stopped at the least opening that produces a stable flame at the main burner unit. If steam demand is still too small at this firing rate to halt the rise in boiler steam pressure, the operating-pressure-limit switch opens, closing the operating-pressure-limit control valve, which turns off the main burner unit. First drop in boiler steam pressure automatically opens the operating-pressure-limit control valve, and a further drop causes the throttling valve to begin opening. Drawing, right, above, shows wiring.

OIL SAFETY SHUTOFF VALVE

Automatic-opening, automatic-closing approved for use with heavy oil. See drawings facing page. Remember, heavier oils

Tried and Tested Automatic Combustion

►DESPITE state and local government's insistence on safeguards for automatic-fired boilers, these units accounted for 13% of the 1936-1948 losses from boiler-furnace explosions with all fuels. As a class these boilers run smaller than manual-lighted boilers (averaging below 10,000 lb per hr for units surveyed) and are not constantly attended. They usually have, though, automatic combustion control of a sort that varies the firing rate in response to steam demand. They can be further generalized as having one burner, combustion air or forced-draft fans, and occasionally induced-draft fans.

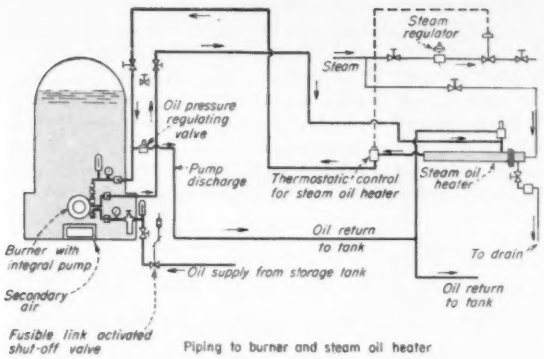
But protection of these units has become unduly complicated. It has suffered from an accelerated development of many different pilots, automatic lighting sequences and nonapproved methods of application to boilers. What should be a straightforward job becomes confused and proves the most dangerous element in operating these boilers. Because of this confusion and a trend toward larger automatic-lighted boilers, the Factory Mutual Engineering Div[1] has put together recommended methods (see summary above) for protecting these units against important fuel-explosion hazards.

There are actually only two danger periods where boiler explosions may occur: (1) during lighting-off (2) while burners are firing.

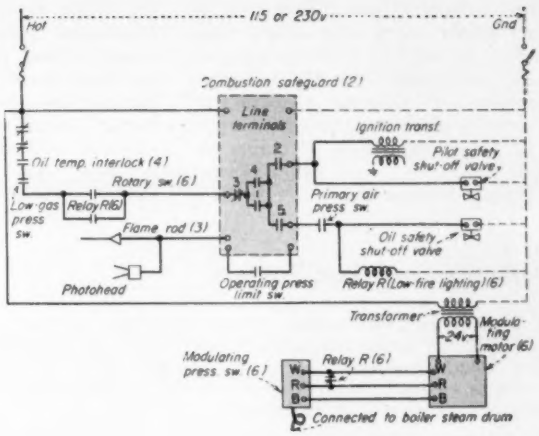
First period occurs with ignition of dangerous accumulations of unburned fuel or flammable products of incomplete combustion left in the furnace chamber from previous operation. It has been responsible for about 60% of the total explosions.

Second danger period—while burners are firing—touches off explosions by

[1] *Preventing Fuel Explosions in Gas- and Oil-Fired Boilers,* Factory Mutual Engrg Div, 184 High St, Boston 13, Mass.



Piping to burner and steam oil heater



adequate protection, reliable operation for today's highly popular unattended packaged boilers

need definite flame stabilization before you're sure they're safe.

Combustion safeguard, No. 2, above. Contacts 1 and 2 close through action of motor-driven cams or thermal warp switches upon a call for heat by the operating-pressure-limit switch, start the burner motor (not shown), and ignite the gas pilot. Contact 3, the safe-start relay contact, must close if you are to get ignition and open safety shutoff valves. When gas-pilot flame contacts the flame rod, the flame-relay contacts 4 and 5 clo e, completing the circuit to the oil safety shutoff valve provided there is proper primary air pressure. After the trial-for-ignition period, contacts 1 and 2 open to shut off the gas pilot and require the photohead to sight the oil flame or shut off the oil and burner motor by opening contacts 4 and 5. Flame-relay contacts 4 and 5 open on flame failure. See wiring diagram, right, above.

Flame rod, No. 3, is located so pilot flame contacts it only where pilot reliably ignites oil.

Oil-temperature interlock No. 4 is set so burner cannot operate unless oil is at temperature recommended by burner manufacturer.

Electric oil heater No. 5 should be located in the piping as close to oil-burner spinner cup as possible. Thus heated oil is available at the spinner cup promptly after safety shutoff valve opens, thereby avoiding pos ible ignition troubles.

Modulating motor No. 6 adjusts firing rate to steam demand by linkages operating the oil throttling valve and primary and secondary air dampers. In closing the throttling valve, travel is stopped at the least opening that produces a stable oil flame. If steam demand is still too small at this firing rate to halt the rise in boiler steam pressure, the operating-pressure-limit switch opens its contacts. This causes the oil safety shutoff valve to close and the burner motor to stop. The first drop in boiler steam pressure closes the operating-pressure-limit switch and starts the lighting-off cycle.

Modulating motor also gives low-fire lighting. Such a motor either has a spring return to the low-fire position upon power interruption or requires electrical power to move from high- to low-fire position. Where a motor is of the power-return type a rotary switch mounted on the motor shaft and wired in the safety circuit should be provided to insure that motor is in low-fire position before ignition of pilot or main burner can be attempted.

Controls Reduce Packaged Boiler Ills

setting afire unburned fuel accumulated after a flame failure or igniting of flammable products left behind from incomplete combustion.

Lighting-Off Period. An approved combustion safeguard assures safe lighting-off. It does it this way. The safeguard detects flame failure and, teamed with program relays, limits amount of unburned fuel discharged to the furnace. This action sequence is known as the trial-for-ignition period. Stack switches and other unapproved safeguards prove too slow. They permit too long a trial-for-ignition time and hence too heavy a build-up of explosive materials. They may be likened to a careless fireman who turns on the main fuel, then waits a minute or two before bothering to check if the main flame has lighted.

In fact, approved combustion safeguards are even more alert than the most diligent fireman. They can sense the main flame promptly and, what's more, prove[2] that a pilot flame is present before ever permitting the main fuel valve to open. With such absolute assurance that an ignition source is present you can design for a longer trial-for-ignition period. This ability extends the automatic lighting feature to heavy oil burners that require definite flame stabilization before you're sure they'll stay lit.

Firing Period. Once the burner is firing, your explosion danger drops off. Only a third of the total explosions reported occurred during the period. And then two out of three happened because of dangerous accumulations of unburned fuel following a previous flame failure. Flammable products of incomplete combustion accounted for the remainder.

Here again, approved combustion safeguards minimize the risks. Where unburned fuel, for example, accumu-

[2]See "Definitions" on page 94.

lates, safeguards can quickly shut the fuel supply safety valve after a flame failure. In build-up of flammable products, you should solve the immediate problem with adequate combustion-air supply to the boiler room for purging and proper adjustment of burner air-fuel ratio.

Proper Safeguards. At beginning of this article a set of numbered recommendations pinpoint essential safeguards for both gas and oil firing. Certain basic requirements must be met. For gas they are: (1) Provide a combustion safeguard and safety shutoff valves in both main- and pilot-burner gas lines. (Each should be approved and the combustion safeguard further approved for type of pilot used. Be certain the safeguard causes the safety shutoff valves to close in a failure.)

(2) Prove the existence of a gas-pilot flame at a point where it will reliably ignite the main burner, before permitting the main safety shutoff gas valve to open. (This is a function of

(*Continued on page* 200)

Definitions and Specifications

1. Automatic-lighted boilers. Unit where pressure- or temperature-controlled devices turn on fuel to main burner automatically. Control arrangement automatically provides (a) electric ignition source or electric-ignited pilot flame, or (b) continuous-burning manually-lighted pilot for main burner.

2. Automatic combustion controls. Devices to vary firing rate with load changes and maintain a constant fuel-air ratio.

3. Combustion safeguard. Control that senses flame presence and causes a fuel-safety shutoff valve to close in flame failure. Any currently approved combustion safeguard shuts off fuel to: (a) main burner by calling for closure of a safety shutoff valve 2-4 sec after receiving a flame-failure signal (b) pilot burner by calling for closure of pilot-safety shutoff valve within 2-4 sec after flame-failure signal, unless control provides a reliable ignition source for relighting pilot. An approved safety shutoff valve closes in not more than 5 sec after call for closure.

4. Supervised flame. A flame whose presence or absence is detected by a combustion safeguard. **Proved pilot.** A pilot flame supervised by a combustion safeguard that senses presence of pilot flame before opening the main burner's fuel-safety shutoff.

5. Flame-sensing element. A flame rod, photoelectric cell or photoconductive cell of a combustion safeguard. A flame rod, generally not suitable for oil, is an electrode extending into the gas flame that, because of the conductive property of ionized gases in the flame, draws a current through it to the safeguard.

Photoelectric cell emits electrons. Emission rate increases on exposure to luminous flames and permits current flow to the combustion safeguard control circuit. Mounted outside the boiler-furnace, cell sights when flame is supervised.

Photoconductive cell's internal resistance lowers on exposure to both luminous and nonluminous flames, thus permitting current flow to the combustion safeguard control circuit, suitable for both gas and oil. Mounted outside the boiler-furnace.

6. Programing combustion safeguard. On lighting off, it turns on ignition system, determines its running time, and when pilot and main fuel valves open. On failing to sense the flame, it shuts off all fuel and locks out.

An approved recycling programing combustion safeguard automatically proves the pilot and repeats the lighting cycle once, following an accidental flame failure. An approved interrupted pilot repeats the lighting cycle only after the trial-for-ignition period is completed and before end of the call for heat. With the non-recycling type, both pilot and main-burner-safety shutoff valves close and lock out, and there is no ignition attempt after flame failure.

Approved programing combustion safeguards work this way:

a. Gas main burner. Pilot flame is proved by the combustion safeguard before letting the main gas valve open, and an interrupted pilot is used to limit trial-for-ignition to 15 sec.

b. Oil main burner. Pilot flame is proved by the combustion safeguard before letting the oil valve open, trial-for-ignition is limited to 60 sec. With an unproved pilot, 15 sec, with no recycle.

7. Trial-for-ignition period. Period of time the programing combustion safeguard permits the main-burner fuel valve to be open before the main flame-sensing device is required to detect the main flame. If this flame is not detected, all fuel is shut off and locked out at once, and there is no further ignition attempt.

8. Pilot-flame-establishing period. Length of time the combustion safeguard permits the pilot fuel valve to be open before the flame-sensing device is required to detect pilot or main flame.

9a. Continuous pilot. Only the fireman can light it. Burns without turndown entire time the boiler is in service, whether main burner is firing or not. Upon pilot-flame failure without the presence of a supervised main flame, the combustion safeguard should call for shutoff of both pilot and main burner fuel.

9b. Interrupted pilot. Device electric-ignited automatically each time there is a call for heat. Programing combustion safeguard usually cuts off pilot fuel automatically at end of main burner's trial-for-ignition period, so main flame supervision must begin. But with a photoelectric, supervised, main oil flame with proved interrupted gas pilot, the pilot flame need not cut off automatically until some predetermined time after trial-for-ignition period. This is true provided the programing combustion safeguard interrupts the pilot flame detection (flame rod) circuit at end of trial-for-ignition period so main flame supervision must begin. In either case, should the pilot fail to ignite upon a call for heat, the programing combustion safeguard closes and locks out the pilot safety shutoff valve after it has remained open not longer than a pilot-flame-establishing period of 60 sec.

9c. Intermittent pilot. It is electric-ignited automatically each time there is a call for heat. It burns during the entire time the main burner fires, and shuts off with the main burner at end of call for heat. Should the pilot fail to ignite upon a call for heat, programing combustion safeguard closes and locks out the pilot safety shutoff valve after permitting a pilot-flame-establishing period of not more than 60 sec.

Acceptable intermittent pilot works as follows:

Main Burner—Gas. Proved intermittent gas pilot: With a gas-fired main burner or burner unit and flame rod or photoconductive supervision, the flame rod or photoconductive cell cannot distinguish main from pilot flame. So there can be no trial-for-ignition period nor supervision of the main flame exclusively. For these reasons the interrupted pilot is preferred.

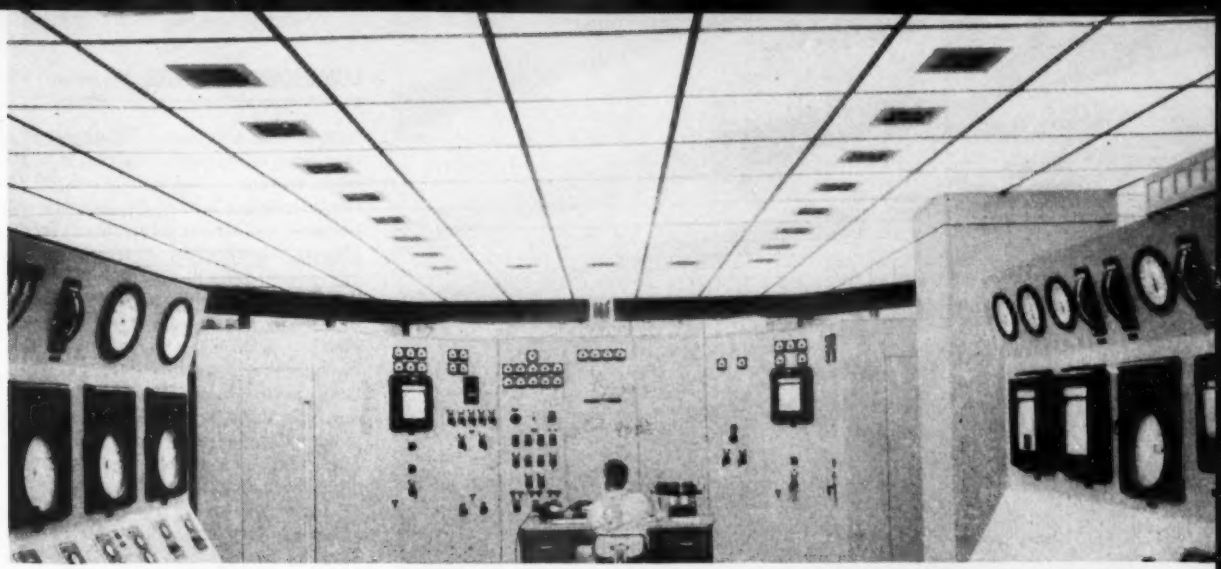
Main Burner—Oil. Proved intermittent gas pilot: With a photoelectric supervised oil flame, locate the flame rod as nearly as possible to a point where pilot flame insures oil ignition from the pilot before the programing combustion safeguard permits turning on the oil. The only programing combustion safeguard approved for this arrangement interrupts the pilot-flame-detection (flame rod) circuit at end of trial-for-ignition period.

Unproved intermittent gas pilot: The trial-for-ignition period of the photoelectric or photoconductive supervised oil flame is limited to 15 sec. If the main flame is extinguished at end of trial-for-ignition period, the programing combustion safeguard closes, and locks out the pilot and main-burner-safety shutoff valves.

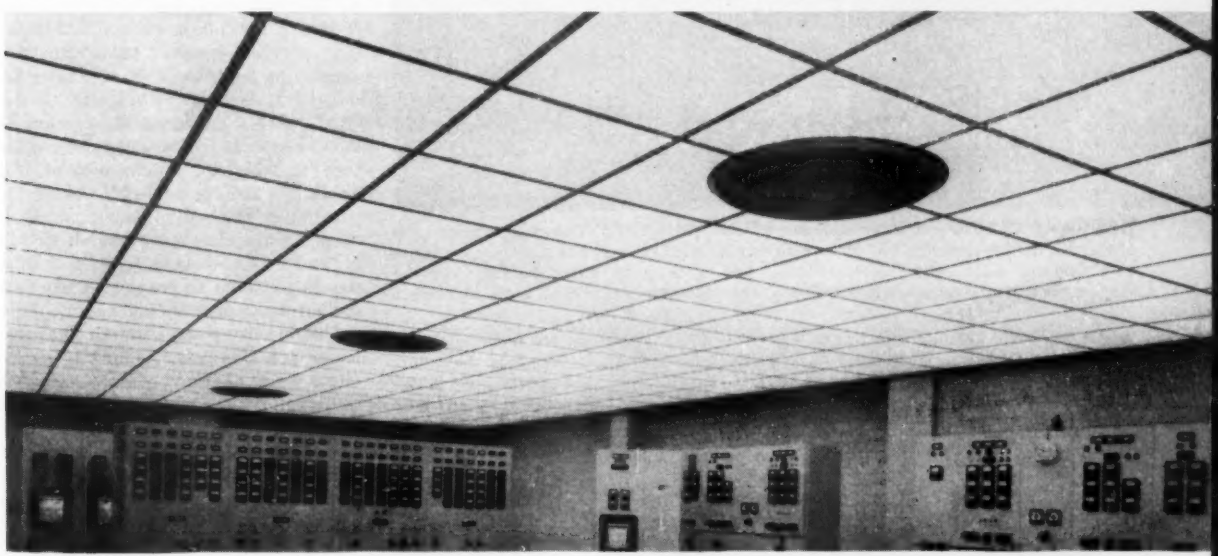
An expanding pilot, lighted by the fireman, normally burns at a low turndown throughout the time boiler is in service, whether the main burner is firing or not. Upon a call for heat the pilot automatically expands to reliably ignite the main burner, and turns down at end of this burner's trial-for-ignition period so main flame supervision must begin. In the expanded condition, pilot operates and is safeguarded the same as an interrupted pilot.

10. Safe-start component check. A checking circuit, usually built into the combustion safeguard. It prevents lighting off if the flame relay contacts are in an unsafe position.

11. Power burner. Either gas or air, or both, are supplied at pressures exceeding, for gas, the line pressure, and for air, atmospheric pressure; this added pressure is applied at the burner.



RECESSED INCANDESCENT lamps supplement 48-, 72-, 96-in. 430-ma Slimline lamps in this installation. The 150-watt incandescent units provide horizontal lighting for control board. Luminous ceiling delivers average lighting level of 125 ft-c



COLD-CATHODE lamps supply 52 ft-c lighting level. Room is 71x40 ft, ceiling is 11 ft high. Light source is 3500-k, white, 25-mm, 100-ma, cold-cathode lamps connected in series. Two lamps are 17½ in. above each panel, spaced 14 in. apart

Modern Control-Room Lighting With...

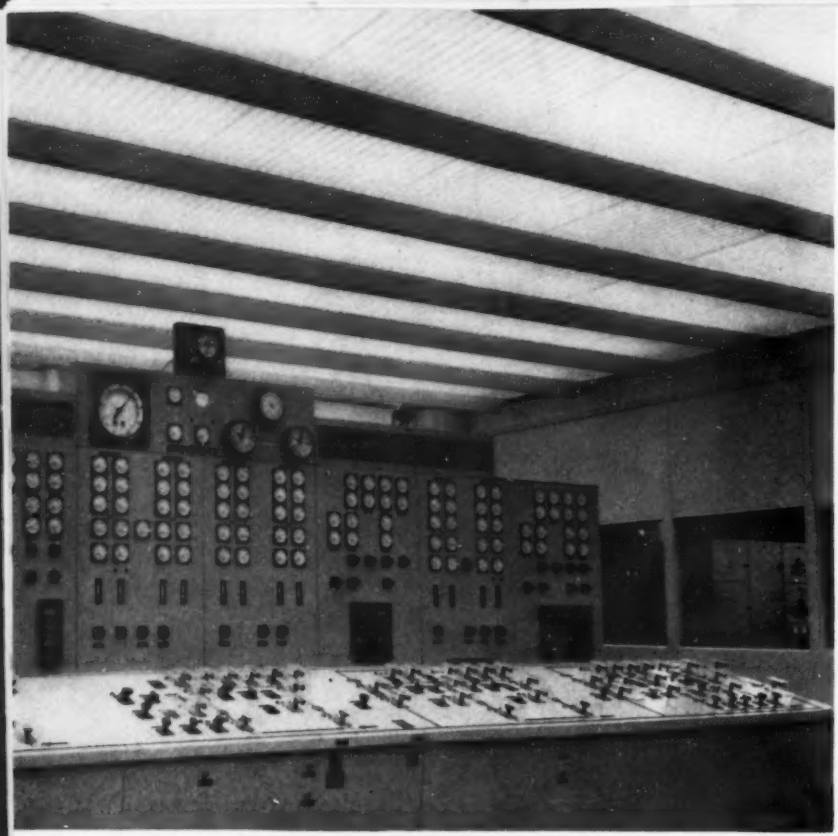
...Luminous Ceilings

Consider a luminous ceiling as a lighting fixture large as the room. Ceiling consists of lighting source, straight runs of lamps with diffusing panels hung below wall to wall over-all shadow-free luminous ceiling.

► PLASTIC used as light-diffusing medium is finding many applications in the power field. On these three pages are shown typical applications for control-room lighting. The same basic lighting plan is being used for offices, banks, hospitals, laboratories, etc. In essence, the lighting scheme consists of a plastic light-diffusing bed below banks of fluorescent lamps producing an even,

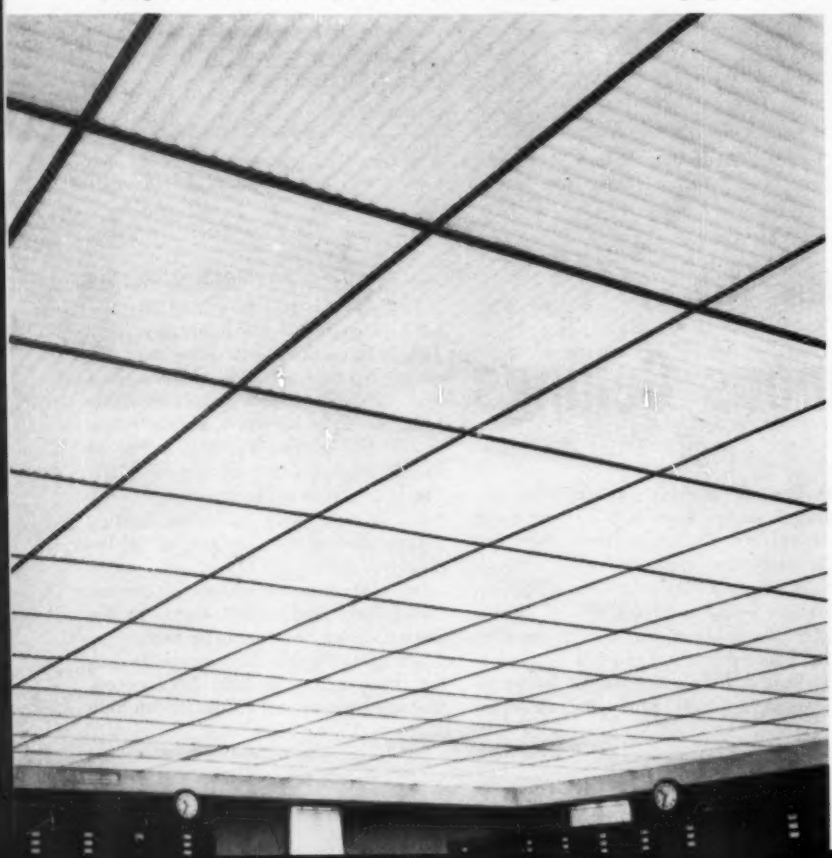
Every square inch of a luminous ceiling is a source of low-brightness light. This is in marked contrast to the "pinpoint" lighting methods of yesteryear. The diffusing panels eliminate glare from the light source. Lighting values of 100 foot-candles and higher can be had at the working level without glare. The glare angle is important in control-room lighting. With individual lighting fixtures the glossy surface of tables, glass-top desks, instrument and meter faces often pick up images of concentrated light and reflect them, to the annoyance of the operating men.

Diffusing Panels. In a luminous ceiling the panels take light from a concentrated source and diffuse it with high



THREE-WAY CEILING combines wall-to-wall diffused lighting, sound absorption with acoustical baffles and delivery of conditioned air through multiple openings at edges of corrugated diffusers. This installation has a designed initial lighting level of 95 ft-c and a working level of 55-60 ft-c over approximately 1325 sq ft of surface

WHITE TRANSLUCENT plastic sheets, 48×48 in., 0.125 in. thick are mounted below fluorescent tubes. As in previous illustrations, acrylic plastic is used as the translucent light-diffusing medium. The sheets are light weight; a 4-sq-ft panel, 0.125 in., weighs 12 lb. Sheets may be removed for cleaning or tube changing by one man



LUMINOUS CEILINGS *continued*

transmitting efficiency. White translucent plastic transmits all but a negligible amount of the light given off by the fluorescent lamps. By painting the surfaces and structural members in the plenum white (space above the diffusing plane), light is reflected back through the panels giving measured transmitting values up to 97%. Acrylic plastic transmits light uniformly through the visible color range. Since lamp outlines are not visible from below, the diffusing panels become the apparent light source for the room. Since there is a uniform lighting effect there are no shadows cast.

The plastic sheets are light weight; a 4-ft-sq panel, 0.125 in. thick, weighs 12 lb. Sheets may be removed safely by one man for cleaning or access to the fluorescent lighting above. Sheets may be cut with a standard fine-tooth saw. Where panels must be cut to accommodate anemostats or to fit into the supporting framework, the work can be done with ease on the job site. Corrugated panels are available in several sizes. For example, one has an amplitude of 1 in. and a frequency of 2½ in. In this size, panel lengths to 48 in. parallel to the corrugations may be used. Another has an amplitude of ⅜-in. and a 1-in. frequency. In this case panels to 30-in. in length, parallel to the corrugations, may be used.

Lighting Layouts. Distance between lamps and translucent ceiling is generally not less than 2/3 the distance between lamp rows to give an even light distribution above the plastic. And distance between lamp rows is found by first selecting desired foot-candles wanted at the working area, then applying the lumen method of general lighting design (see *Illuminating Engineers Handbook*). Suitable coefficients of utilization are selected for bare lamps with allowance for efficiency of the plenum.

Let us review some of the lighting terms met with in the laying out of a luminous-ceiling job. Unit for quantity of light is the *lumen*. It is the amount of light falling on a surface 1 sq ft in area when the light source is a standard candle. Or look at it another way. Consider a standard candle in the center of a sphere having a 1-ft radius. Candle has an intensity of 1 candle-power in every direction; hence each sq ft of the sphere will receive one lumen. A sphere with a 1-ft radius has an area of 12.57 sq ft. So a standard 1 candlepower source gives off 12.57 lumens.

Remember, the lumen is a unit of quantity. Therefore the amount of light it represents will not be changed if spread over a greater or less area. This is an important thought in connection

with luminous ceilings. A lumen is like a gallon of water; it's a gallon whether in a can or spread on the control room floor. Illumination is the amount of light per unit area. Unit of illumination is the *foot-candle* (ft-c). This is the light density when one lumen is spread equally over a 1-sq-ft surface.

Brightness is what makes things visible. We cannot see ft-c, but we can see the brightness they produce. Unit of brightness is the *foot-lambert* which is the brightness of a perfect reflecting surface, giving off one lumen per sq ft. Another way to look on brightness is to take a wall where 20 lumens are falling on each sq ft; in other words, 20 ft-c. If the reflectance is 50%, the wall will send back 10 lumens per sq ft and the brightness is 10 foot-lamberts.

A luminous ceiling controls the brightness ratio between light source, room surfaces and visual tasks. Ratios are brought within the preferred 3:1 value. This 3:1 ratio stipulates the brightest surface, the light source, should not be more than three times as bright as the working area. And the working area should not be more than three times as bright as the darkest surface in the room. Eye strain increases when ratios go higher than 3:1. The luminous ceiling well satisfies the 3:1 ratio guide.

Easily Installed Luminous Ceiling Is Simple to Maintain

THERE ARE several practical thoughts to consider when you install a luminous ceiling. First, the building ceiling, side walls, ducts and beams should be painted white to give a reflectance of 80% or more on all exposed surfaces. Bare lamps are installed with their channels flush to the building ceiling or suspended from hangers. Modern fluorescent lighting strips lend themselves to this type installation.

Lamp reflectors are generally used only where it is not possible to reach the over-all 80% reflectance figure. Typical would be the case where ducts and piping radically break up flatness of the building ceiling surface. Reflectors, under such conditions, yield a maximum initial down-light from the lamps, while preventing any upward component of light from being trapped in the ducts and piping.

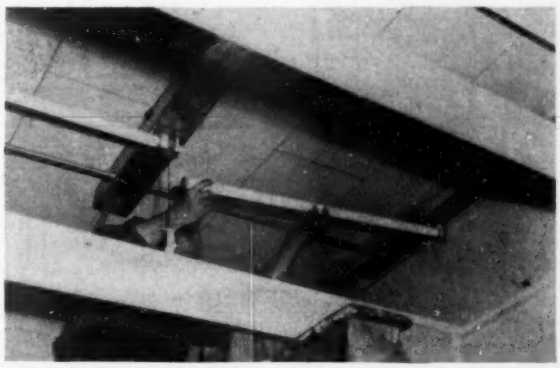
Where a lower finished-ceiling height is permissible, nothing need be removed to install a luminous ceiling. The existing ceiling, side walls and piping are painted to improve reflectance and new wiring and channels installed. In large areas it's quite practical to install the luminous ceiling by bays, finishing additional sections when needed.

Air Conditioning. With the acoustical-baffle "package" design, sprinklers may be installed within baffles with little change in appearance of the finished installation. Likewise there is provision for air conditioning. Air can be introduced or exhausted through spaces between the corrugated plastic diffusers and the flat baffle rails on which they rest. Although each of these spaces has an area of about 1 sq in., their great number yields a large total area for air movement. Averaging 3.2 sq in. for each sq ft of ceiling, the openings provide about 920 sq in. of space for air passage in a 16x16 ft room. This large area of openings, plus their dispersion over the entire ceiling, makes it possible to deliver air at a very low velocity.

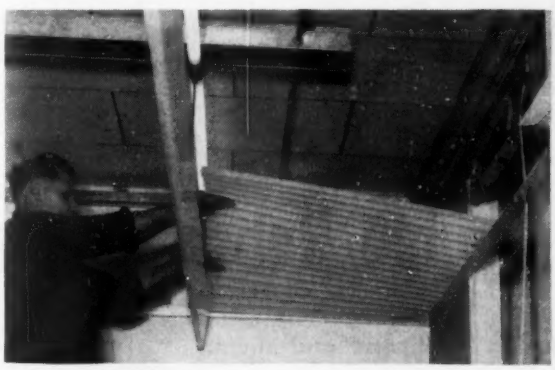
With this particular ceiling design, all the air-diffusing equipment and most of the conventional ductwork can be eliminated. Ducts need be run only to the space above the luminous ceiling. The air conditioning can be zoned by dividing the plenum space into compartments with simple baffles.

Maintenance of components in a luminous ceiling installation is relatively easy since sheets may be readily lifted from their supports and removed. Usually plastic panels should be cleaned every three to six months. Wash with a detergent, then apply an anti-static wax. Lack of a periodic cleaning program leads to a lower lighting level in the room plus an unpleasant surface appearance.

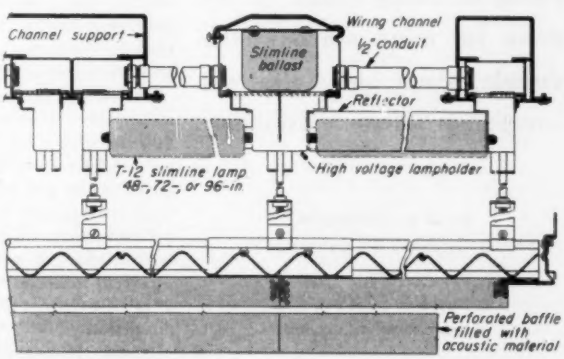
Photographs and most of the data for this article were supplied by Rohm & Haas Co and F W Wakefield Brass Co.



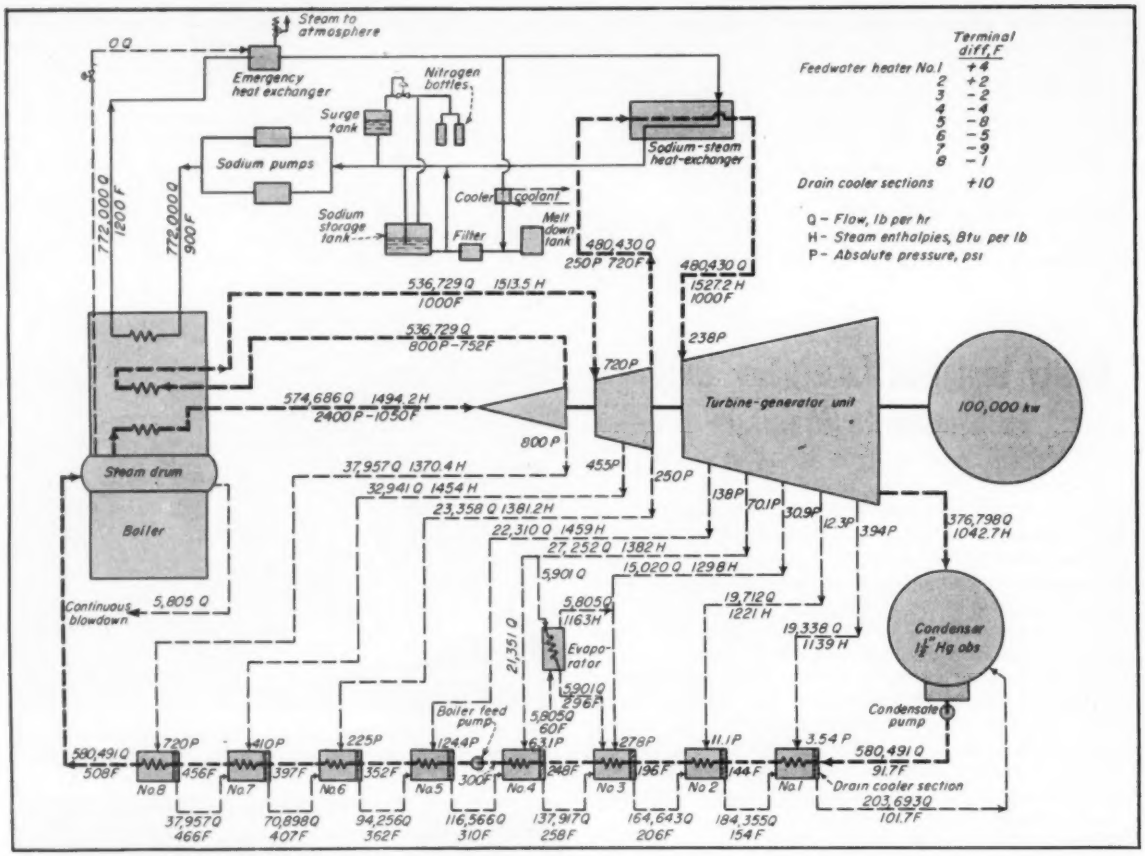
WITH EXISTING CEILING, wiring channels are first laid out, acoustical baffles installed wall-to-wall; support from above



PLASTIC PANELS laid in place as last step. This ceiling may also be used for the air-conditioning supply and exhaust



ACOUSTICAL BAFFLE, suspended from channels above, serves to deaden sound and to shield sprinkler heads where needed



PLAN D, DOUBLE REHEAT CYCLE uses the liquid metal, sodium, as heat carrier to resuperheat steam at the second reheat point in the turbine circuit. Despite the increased investment in added equipment this cycle may prove a practical possibility

Double Reheat Cycles—the Next Step?

Rising fuel costs and metallurgical limitations led the swing to reheat cycles. In the drive for more economy the double reheat cycles offer encouraging future possibilities

By **R H SHANNON**
United Engineers & Constructors Inc
and
J D SELBY
General Electric Company

► THE REHEAT CYCLE now used in power plants (1) increases plant thermal efficiency (2) reduces turbine maintenance by lessening moisture in exhaust steam. Using two stages of reheating, instead of one as at present, offers practical possibilities of further raising plant thermal efficiency.

Instead of piping steam back to the boiler for reheating, a heat-carrying fluid may be used. A liquid metal like sodium may circulate between a heater in the boiler gas pass and an exchanger near the turbine where steam emerges for reheating. With the sodium-steam heat exchanger near the turbine it is practical to design for a steam-pressure drop of 5% of reheat pressure leaving the turbine.

Study. In the table, opposite page, it has been assumed that normal reheating in the boiler causes a pressure drop of 10% of reheat pressure, while the heat-exchanger scheme involves only 5% steam-pressure drop. This accounts for the difference in station heat rates for Plan *A* vs *B*, and Plan *C* vs *D* vs *E*. All the plans are based on a 100,000-kw unit with eight stages of feedwater heating. Heat balance for Plan *D* is given in the circuit diagram above. Note that Plan E would use the liquid sodium system at both reheat points.

The sodium circuit includes: sodium-steam heat exchanger, pumps, piping and valves, surge and storage tanks, purifying equipment, gas-pressurizing apparatus, system heating units, equipment for filling system. In addition, an emergency heat exchanger allows the sodium system to dissipate heat during transient periods of startup and shutdown and when turbine steam supply suddenly ceases.

Comparison of Alternate Schemes of Single and Double Reheating Cycles

100,000-Kw Turbine-Generator With Eight Stages of Feed Heating

Plan	A	B	C	D	E
Throttle-steam conditions:					
Pressure, psia	2400	2400	2400	2400	2400
Temperature, F	1050	1050	1050	1050	1050
Turbine-inlet steam conditions, first reheat point:					
Pressure, psia	405	427	720	720	760
Temperature, F	1000	1000	1000	1000	1000
Method of reheating	Boiler	Sodium-stm heat exchanger	Boiler	Boiler	Sodium-stm heat exchanger
Turbine-inlet steam conditions, second reheat point:					
Pressure, psia	—	—	225	238	238
Temperature, F	—	—	1000	1000	1000
Method of reheating	—	—	Boiler	Sodium-stm heat exchanger	Sodium-stm heat exchanger
Condenser pressure, in. Hg abs	1.5	1.5	1.5	1.5	1.5
Boiler feedwater temperature, F	508	508	508	508	508
Turbine-generator unit heat rate, Btu per kwhr	7,502	7,462	7,293	7,256	7,216
Boiler efficiency, %	88	88	88	88	88
Auxiliary power demand, kw	7,000	7,000	7,000	7,000	7,000
Estimated net station heat rate, Btu per kwhr	9,167	9,118	8,911	8,866	8,817
Reduction in net station heat rate compared to Plan A, Btu per kwhr	0	49	256	301	350
Net station output, kw	93,000	93,000	93,000	93,000	93,000
Load factor, %	70	70	70	70	70
Operating hours per year	8,760	8,760	8,760	8,760	8,760
Estimated annual dollar saving compared to Plan A	0	$11,200	$58,300	$68,600	$79,800
Capitalized annual savings at 15%	0	$74,500	$388,000	$457,000	$531,000

For the single-reheat cycles, *A* and *B*, turbine section efficiencies were assumed at 85% for first section and 90% for the second. For the double-reheat cycles *C*, *D* and *E*, the first section was assumed at 85%, the second at 90%, and the third at 92%. A 1% mechanical and electrical loss was used for all cases. Feedwater temperature was assumed at 508 F for all plans.

While there would actually be a small difference in auxiliary power needs for each plan, the demand was assumed as 7000 kw for all. Turbine-shaft gland and valve-steam leakage were taken as zero throughout. Water compression effect on feedwater was neglected for all cases, not affecting the comparisons.

Liquid Sodium System. In the diagram, opposite page, sodium enters the boiler heating section at 900 F and emerges at 1200 F. Sodium has favorable characteristics as a heat-transfer fluid. Local heat-transfer coefficients between tube wall and sodium, equal to 5000 Btu per hr sq ft per F or greater, are easily achieved. Little difficulty should be experienced in limiting boiler-tube-metal temperatures to 100 F above the liquid-sodium temperature.

Centrifugal or electromagnetic-type pumps could be used for moving the molten sodium. From the boiler the 1200-F sodium flows to the steam re-superheater, a simple single-pass tube-and-shell counterflow unit. For this particular application where the sodium-steam heat exchanger is designed for a steam-pressure drop of 5 psi, the unit would be about 4 ft in diameter and 20 ft long.

The two pumps would each have a capacity of about 800,000 lb per hr with 100-ft tdh. This provides 100% standby capacity. For electromagnetic pumps about 100 hp at full rating would be needed. Centrifugal pumps need 80 hp or less. All piping and equipment in the sodium system for superheated steam reheating would be stainless steel.

Since sodium reacts with oxygen, a nitrogen pressurizing blanketing system is needed. The sodium-system purifying, filling and heating equipment are needed only for initial startups or after prolonged shutdown.

Estimated installed cost of the liquid-sodium system, including cost of the initial sodium charge, is about $300,000.

Economic Evaluation. Corresponding to the heat rates shown in table above, each cycle has the following thermal efficiency: *A*—37.2%, *B*—37.45%, *C*—38.3%, *D*—38.5%, *E*—38.7%. Table gives the reduction in heat rate for each plan or cycle referred to *A* as the base. These reductions were evaluated as follows:

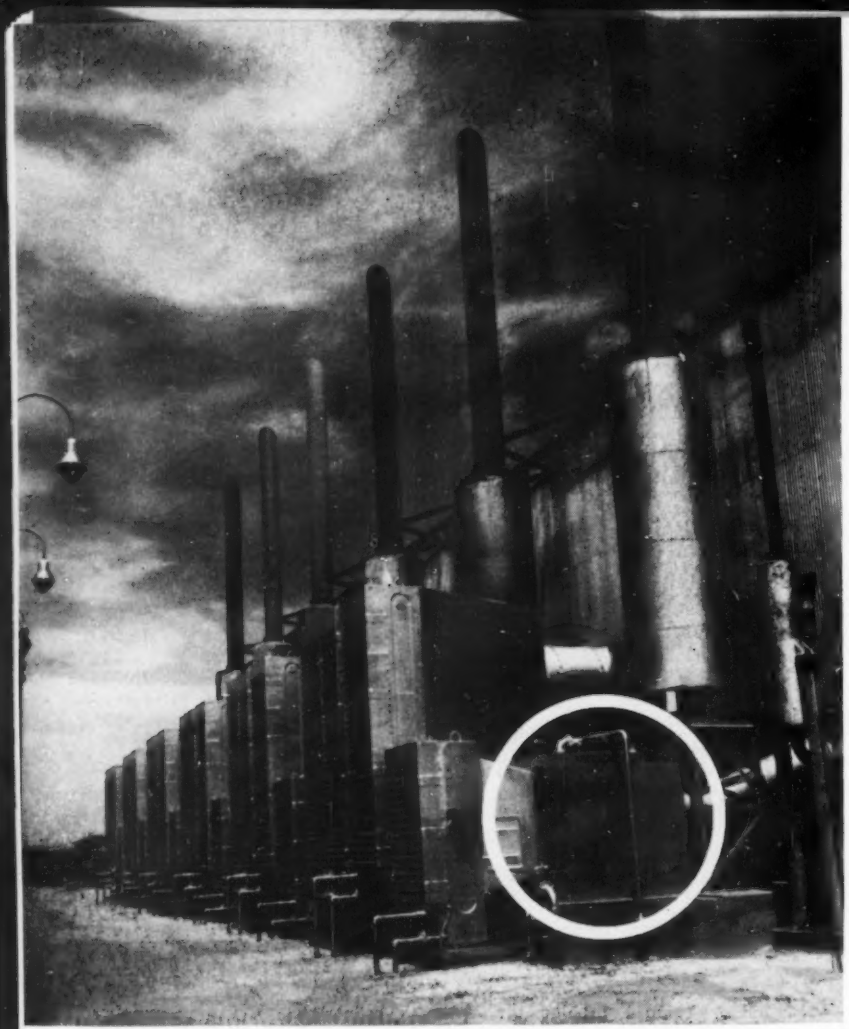
1. Estimated load factor = 70%
2. Fuel cost = 40c per million Btu
3. Fixed charges covering amortization, interest, taxes, insurance = 15%
4. Period hours per year corresponding to load factor of 70% = 8,760
5. Estimated annual dollar saving = (Btu per kwhr reduction) (net kw station output) (hr per year) (load factor) (fuel cost per Btu)
6. Capitalized value of saving = (Estimated annual dollar saving)/0.15

Example

As an example the saving for Plan *B* over *A* is 49 Btu per kwhr, then the annual dollar saving = 49x93,000x8760x 0.7x0.4/10^6 = $11,200.

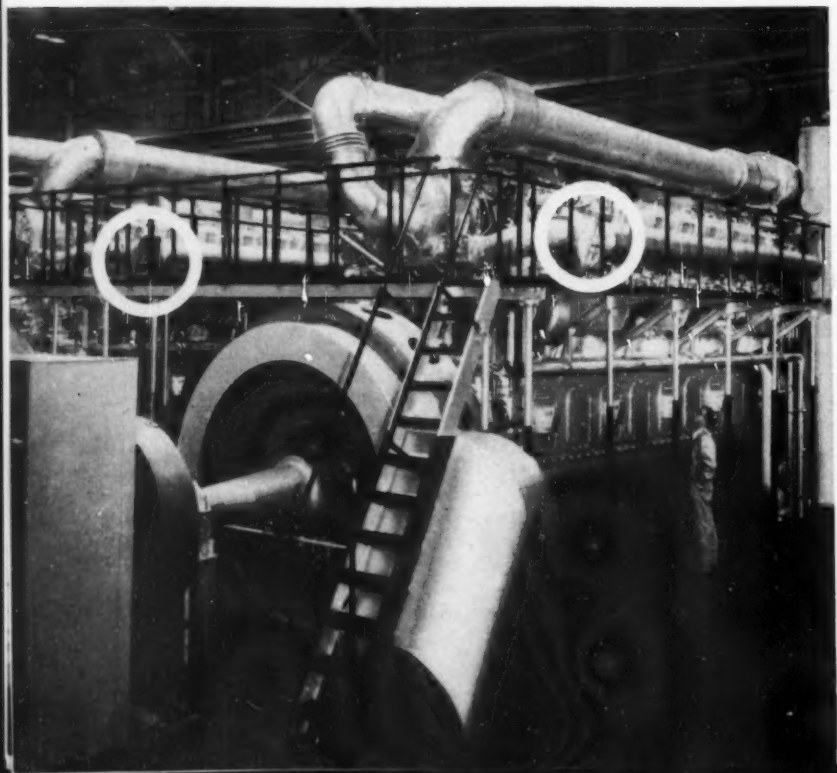
Then capitalized value of saving = $11,200/0.15 = $74,500.

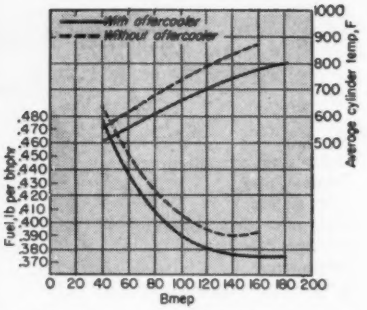
The more-developed plans seem to indicate an adequate margin for any additional costs that might be involved by a slightly more complex turbine structure for the second reheat point. This cycle might be a practical answer to what can be done to fight inflationary fuel costs, while steam temperatures are limited.



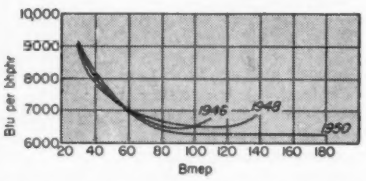
INTAKE-AIR precooler is evaporative wood-fill type. Air leaving cooler passes to the turbocharger mounted at one end of the engine shown below

AFTERCOOLER on each engine in this plant cools air leaving turbocharger. Air temperature in manifold is automatically kept at any desired level

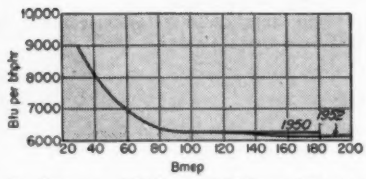




1 Here's how an aftercooler improves 4-cycle supercharged diesel output



2 Steady progress in design reduces supercharged gas-diesel heat rate

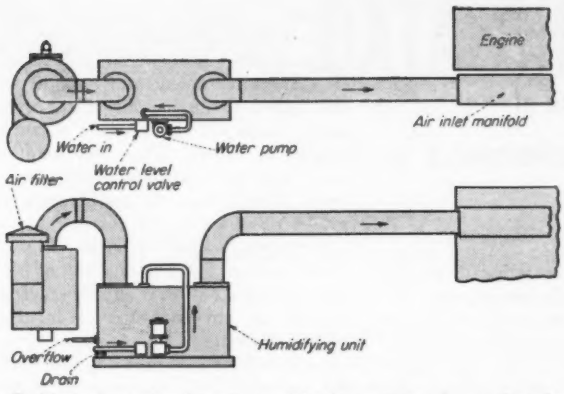


3 Between 1950 and 1952 conditioning systems extended flat heat-rate curve

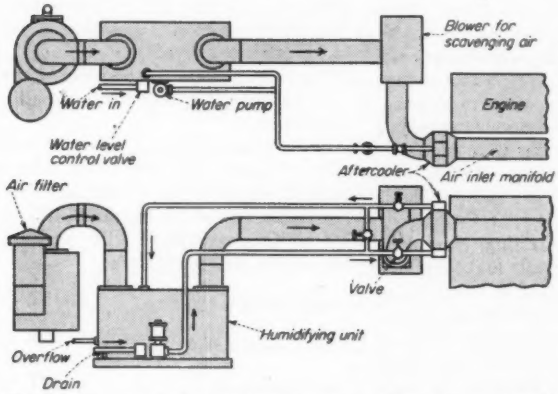
Conditioned

New ways are opened up to more power from a given size cylinder, with no thermal-load increase, by conditioning combustion air for high-compression engines. In climates with high ambient temperatures and low relative humidities the results are especially satisfactory

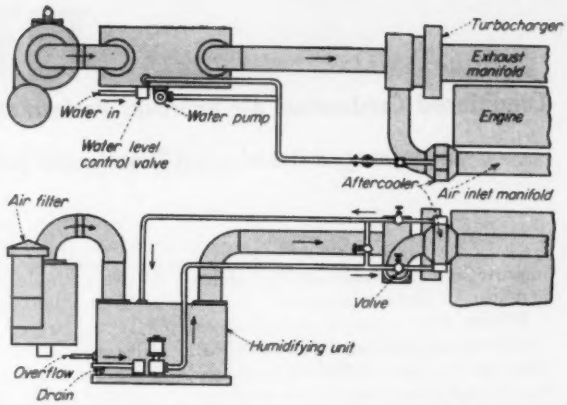
By **W R CROOKS**, *Chief Engineer's Asst*
and
E L MILLER, *Project Engineer*
The Cooper-Bessemer Corp



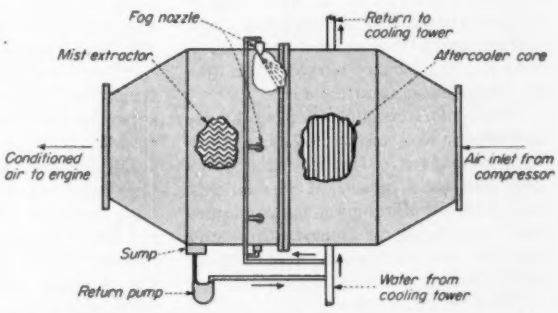
4 Typical combustion-air conditioning system for a 4-cycle atmospheric engine has humidifier between engine, filter



5 Typical combustion-air conditioning system for a 2-cycle pressure-charged engine uses a humidifier and aftercooler



6 Turbocharged 4-cycle engines can be fitted with a conditioning system like this to improve output at all loads



7 Combined aftercooler evaporative cooler has good humidifying efficiency, is located on compressor's pressure side

Combustion Air Jacks Diesel Output

► THE GREATEST CHALLENGE to the diesel-engine industry has always been development of more efficient and economical prime movers. Notable achievements since 1936 include (1) diesel-engine supercharging to increase power output by 50% (2) production of highly flexible and efficient gas-diesel atmospheric and supercharged engines and (3) development of spark-ignited high-compression supercharged engines using natural-gas fuel. Thermal efficiency of latter runs to almost 40%.

Higher ratings and reduced specific fuel consumption are made possible by continuing design and research studies. As a result we see increased compression ratios on atmospheric gas engines, improved turbochargers, scavenging systems, ignition and gas-injection systems and materials.

Intake Air. Today much attention is directed toward conditioning combustion air as an added step in developing more power from an engine of given size. Before 1946, need for cooling combustion air did not exist on most engines because specific output was relatively low. All gas engines were low-compression types. Load-carrying ability was limited by inability to efficiently burn the rich fuel charge present in their cylinders.

Overload capacity of 10% in these engines was more than enough to take care of changes in oxygen content of air with temperature. For instance, at 120-F intake temperature, content is only 5% less than at 90 F. Engines had sufficient reserve load-carrying capacity at elevated temperatures.

Supercharged Engines. During this same period 4-cycle supercharged diesels were rated at 115-psi brake mean effective pressure (bmep) with turbocharger pressure ratios up to 1.3. Air reaching engine was at 140 F on a 90-F ambient day. Combustion-air temperature was not an important factor.

When atmospheric gas-engine compression pressures were upped from 100 to 450 psi, conditioning of combustion air became economically justifiable. Developments in supercharged gas-diesels and spark-ignited high-compression gas engines raised bmep to 180 psi before detonation limited output and pointed the way toward study of conditioning systems for combustion air.

Equipment. Radiator-type heat exchanger between turbocharger and air-inlet manifold was first conditioner tried. Cooling medium was water. On low-rated supercharger diesels we could see no advantages.

But later developments on 4-cycle high-compression supercharged gas and diesel engines, having turbochargers with pressure ratios of 2 to 2.5, showed

Conditioned Combustion Air Improves Performance of Supercharged Diesels, Gas-Diesels and Gas Engines

improvement in load-carrying ability and specific fuel consumption.

Effects. Fig. 1 shows typical effects of aftercooling on a supercharged diesel. Note that besides a reduction in specific fuel consumption there is increased load-carrying ability for a given thermal load on piston, rings, valves and other parts.

If maximum allowable cylinder-outlet temperature is 800 F on engine with aftercooler, maximum permissible load is 180-psi bmep, Fig. 1. Same engine without aftercooling is limited to about 130-psi bmep. So we can say thermal load at 130-psi bmep is same as at 180-psi bmep using an aftercooler.

Aftercoolers on supercharged 4-cycle gas-diesel and spark-ignited gas engines have perhaps a more important function than on a diesel. It was quickly learned while developing these engines that scavenging-air temperature and quantity fix maximum load-carrying ability before reaching detonation.

These engines require an air-fuel ratio of 17 to 1 on the rich side, 30 to 1 on the lean. Controls maintain air-fuel ratio as near 17 to 1 as possible to avoid detonation. If it occurs, it indicates mixture is too rich for existing conditions. Cylinder temperature alone limits maximum load on diesel engines, whereas detonation is the limiting factor for gas-diesel and spark-ignited gas engines. In the latter detonation results from pre-ignition or extremely fast burning of the gas charge.

Aftercoolers. Fig. 2 shows effect of an aftercooler on a supercharged gas diesel and progress made over a 4-year period. Fuel consumption indicated for the 1946 engine was obtained on the prototype of a present-day engine.

Improvements in 1948 on gas-admission and ignition equipment produced fuel curve indicated. Curve turn-up above 120-psi bmep was, along with detonation, the clue for need for cooler air. Effect of an aftercooler is shown in 1950 curve. It is considerably flatter, permitting ratings to 180-psi bmep before detonation limits output.

Using detonation as limit on output, aftercooler alone permits rating increases to 30% over 1948 engines, and 56½% over 1946. Study of curves in Fig. 2 shows that detonation limit of 180-psi bmep can be raised if more effective means can be found to further reduce combustion-air temperature.

Trying larger aftercoolers shows that price and size are prohibitive. Studies and tests developed a true conditioner for combustion air. It humidifies and cools incoming air, allowing ratings to 200-psi bmep before detonation.

Fig. 3 shows 1950 fuel curve, along with 1952 curve for a unit having a conditioner. Although evaporative cooling was first used solely to reduce combustion-air temperature to increase specific output, it soon became apparent that certain other gains were made on atmospheric 2-cycle gas engines and supercharged 4-cycle gas and gas-diesel engines.

Besides increasing rating, conditioning system lowers specific fuel consumption, improves combustion characteristics by more orderly flame propagation, lowers cylinder heat load to increase life of rings, pistons, valves and other parts, and eliminates deration for high ambient temperatures.

Improving combustion is particularly significant because fuel gases with higher detonating characteristics than natural gases composed largely of methane can be burned.

Locality. Heretofore it has generally been considered that evaporative cooling equipment could be successfully used only in semi-arid climates. Analysis of wet-bulb temperatures on the Gulf coast shows they have not exceeded 84 F. This means that an evaporative cooler can cool air to 90 F anywhere in the U. S. Standard rating temperatures of the Diesel Engine Manufacturers Assn are based on an inlet-air temperature of 90 F.

Atmospheric Engine, 4-Cycle. Assume two initial conditions, one with 115-F dry-bulb (d-b), 65-F wet-bulb (w-b), the other with 100-F d-b and 84-F w-b for inlet air. Here's what a conditioning system will do for a 4-cycle atmospheric engine:

	Case 1	Case 2
Initial conditions	115-F d-b 65-F w-b	100-F d-b 84-F w-b
Cooling to within 5 F of w-b gives engine combustion air at	70-F d-b 75% rh*	89-F d-b 70% rh*

*Relative humidity

Case 1 represents semi-arid conditions, 2 the Gulf coast.

Fig. 4 shows system used. It is simply an evaporative cooler and humidifying unit piped to engine air inlet. Small water pump circulates water to spray nozzles in cooler. Water consumption under average conditions is 0.15 lb per hphr. This brings air temperature to within 5 F of w-b temperature.

Pressure-Charged, 2-Cycle. Fig. 5 shows system for gas engines of this type, having a blower to supply scavenging air at pressures to 4.5 in. Hg. Similar to unit in Fig. 4, pump circulates 50-100 gpm through fog nozzles in the cooler. Water consumption under average conditions runs 0.3 lb per hphr. Evaporative cooler can reduce air temperature to within 7 F of ambient w-b. Aftercooler on blower discharge is sized to lower air temperature to within 15 F of cooling medium temperature. Latter is a variable depending on prevailing conditions.

Without conditioning, an engine with 115-F d-b and 65-F w-b air at inlet at 3000-ft elevation in a semi-arid area receives air from blower at 153-F d-b, 1% rh (approximate). With conditioning equipment, results are:

Initial conditions	115-F d-b 65-F w-b
After evaporative cooler	72-F d-b 70% rh
After compressor	107-F d-b 29% rh
After aftercooler; combustion air supplied engine	87-F d-b 40% rh

Further gains are made by adapting the same basic system in a slightly different manner, bringing air through compressor and a combined aftercooler-evaporative cooler to air-inlet manifold. Fig. 7. This system utilizes the aftercooler more efficiently than is possible with hookup in Fig. 5. Humidifying efficiency of evaporative cooler is improved because it's used on the discharge side of compressor instead of inlet side.

With same initial conditions earlier assumed, combustion air is supplied engine as follows:

Initial conditions	115-F d-b 65-F w-b
Air from compressor	153-F d-b 77-F w-b
Air from aftercooler	95-F d-b 59-F w-b
Air from evaporative cooler to engine	66-F d-b 66% rh

Gains. Conditioner in Fig. 7 not only lowers air temperature to a level 21 F below that in Fig. 5; it also raises rh 26%—from 40 to 66%. Gain is signifi-

(*Continued on page* 206)

Power's DATA SHEET

No. 248

Table of Economical Chimney Sizes

Based on 68-F atmospheric temperature, chimney-gas specific weight 0.0772 lb per cu ft, elevation 851 ft (29.0 in. Hg) above sea level, friction coefficient 0.018

Chimney delivery, lb gas per sec	Gas temperature, 500 F: Economical chimney-gas velocity, ft per sec	Gas temperature, 500 F: Economical chimney diameter,* ft	Total dynamic draft, in. wg	Economical chimney height, in feet: Chimney gas temperature 400 F	500 F	600 F
5	17.94	2.90	.25	58	49	44
10	21.13	3.83	.30	69	59	52
15	22.86	4.50	.35	81	69	61
20	24.19	5.05	.40	92	79	70
25	25.25	5.54	.45	104	88	79
30	26.31	5.96	.50	116	98	87
35	27.11	6.34	.55	127	108	96
40	27.78	6.67	.60	139	118	105
45	28.31	7.01	.65	150	128	114
50	29.11	7.30	.70	162	137	122
55	29.64	7.59	.75	173	147	131
60	30.17	7.85	.80	185	157	140
65	30.70	8.11	.85	197	167	149
70	30.97	8.35	.90	208	177	157
75	31.50	8.58	.95	220	186	166
80	31.90	8.81	1.00	231	196	175
85	32.29	9.02	1.05	243	206	184
90	32.69	9.24	1.10	254	216	192
95	33.09	9.44	1.15	266	226	201
100	33.49	9.64	1.20	277	236	210
110	34.02	10.00	1.25	289	245	219
120	34.69	10.37	1.30	301	255	227
130	35.29	10.70	1.35	312	265	236
140	35.75	11.02	1.40	324	275	245
150	36.15	11.33	1.45	335	285	254
175	37.34	12.05	1.50	347	294	262
200	38.41	12.72	1.55	358	304	271
225	39.34	13.33	1.60	370	314	280
250	40.14	13.90	1.65	381	324	289
275	40.80	14.45	1.70	393	334	297
300	41.60	14.95	1.75	405	349	306
325	42.26	15.44	1.80	416	353	315
350	42.93	15.90	1.85	428	363	324
375	43.46	16.34	1.90	439	373	332
400	43.99	16.77	1.95	451	383	341

*Gas temperature has little effect on diameter over wide range.

By J G Mingle, *Indianapolis, Ind.*

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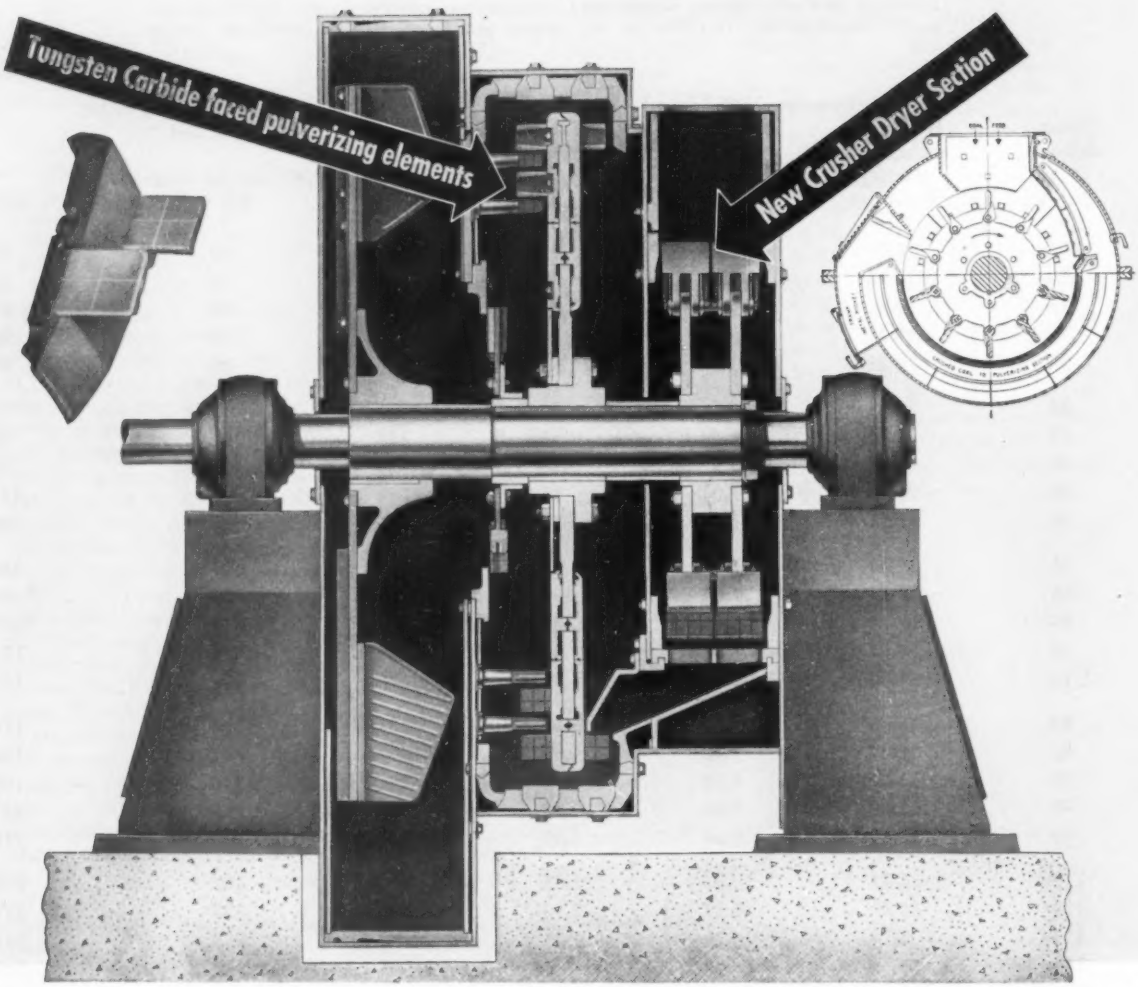
The New "RILEY 50" Pulverizer



Pulverizing elements of the New Riley "50" Pulverizer are faced with tungsten carbide, assuring years of continuous service, low maintenance and sustained fineness without adjustments. The crusher-dryer section evaporates surface moisture so that moisture content of coal does not affect capacity. Foreign materials are also rejected in this section and coal is crushed to fine granular state, without damage to pulverizer.

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16. Thoroughly dependable.
17. Negligible cost of lubrication.
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19. Primary air fan integral with pulverizer —separate fan and motor not required.

All of these people have ordered Riley "50" Pulverizers within the past two years

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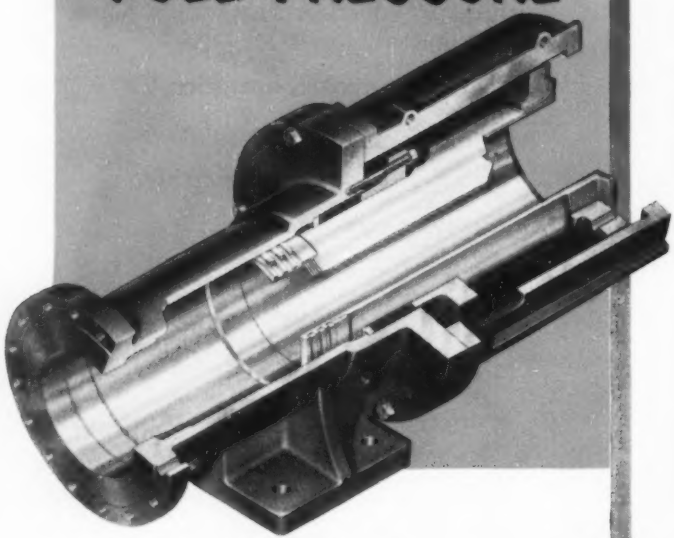

▶ ADSCO piston-ring expansion joints can be serviced . . . in fact, unpacked and repacked . . . under full line pressure. There is no interruption of service, no down-time for repacking, because the job is done under normal working conditions.

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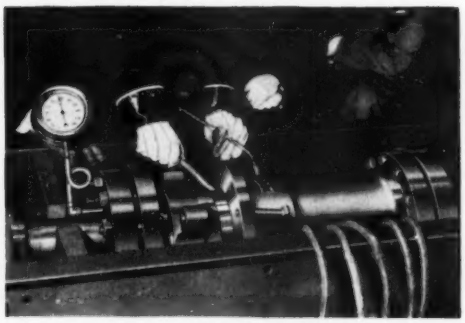
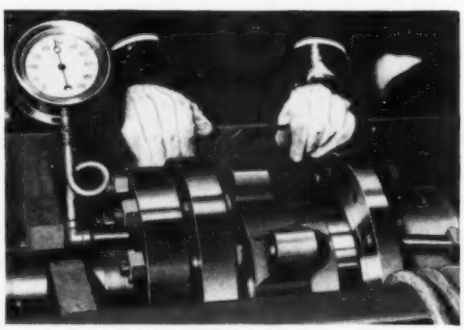


Last strand of packing being withdrawn from stuffing box.



Close-up photograph shows all packing removed. With steam at 240 lbs. pressure and with 300° superheat there is no trace of steam in the empty stuffing box.

With periodic adjustments of the gland, it may never be necessary to repack the stuffing box in an ADSCO piston-ring expansion joint. However, lack of maintenance may make it necessary at some time to do so and the job is easy with this ADSCO joint. The piston rings hold the line pressure during the unpacking and repacking operation. With the vent valve open, the vent chamber is at atmospheric pressure and, under this condition, no steam can enter the stuffing box space. Thus complete repacking can be done under full line pressure.

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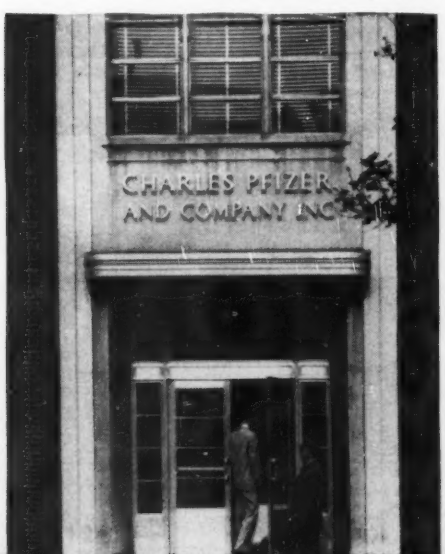
A CENTURY of experience backs up maintenance plan that provides around-the-clock operation



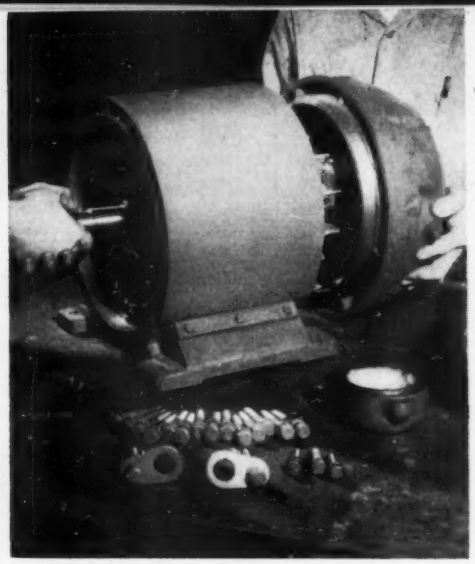
1: 'Start at Equipment Selection,' *D C McClain, Dir Engrg*

2: 'Organize Men and Methods,' *W R Townsend, Chief Engr*

3: 'Modern On-The-Job Techniques,' W Krauss, Elect Engr

TURN PAGE ➡

MOTOR STOCK ROOM houses some 200 motors for replacements and for new-process needs. Explosionproof motor frames are used throughout, increasing flexibility



CLASS H insulation for rewinds; Class B for new motors; considering H for all

ELECTRICAL MAINTENANCE *continued*

...1-Design and Equipment Selection...

► THE MODEST 5000-KW LOAD at Pfizer is carried by the local utility's network system. Many separate services feed 3-phase, 120/208-v to 14 load centers, each with a 4000-amp rating. Small motors form bulk of the loads. There are 3000, ranging from a ¼-hp handful to a sizable 300-hp job. Since motors are at the core of every electrical maintenance program, let's first study this company's approach to their selection.

Motor selection is straightforward; the explosionproof type is used throughout. Costly? First cost, yes. But look a little farther. True, many applications in the plant could be met with an open or splashproof enclosure. But with explosionproof frames, all motors can be used freely in hazardous and other areas. Right off, that interchangeability feature reduces the number of replacement types to carry in stock. Also, periodic maintenance is reduced to cleaning motor's outer frame. Dust, dirt and corrosive vapors just can't get in.

Class B insulation is specified for all new motors. Motor rewinds are done with Class H. And here's why. They've traced many motor failures to high ambient temperatures. Production department is continually reaching for higher temperatures. Class H gives that extra measure of temperature protection where process temperatures are suddenly upped. Right now Class H for all new motors is being considered.

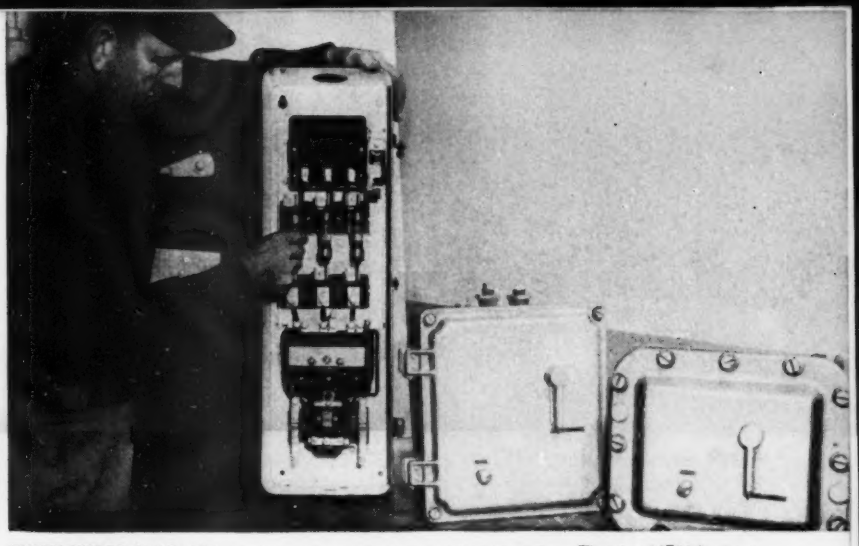
Motor stock tally hovers around 200, ranging from ¼ to 25 hp. This gives a comfortable replacement margin for about 90% of the motor types in the plant. There are no replacements for noncritical special motors . . . but an overnight rewind service is available. Stock motors serve a twofold purpose: emergency replacement and a ready supply for new process that must be built on short order. Process changes in the chemical industry generally can't wait for drawnout motor deliveries. Hence the stocking of the most-often

HERE ARE THE HIGHLIGHTS ON EQUIPMENT SELECTION

- **Explosionproof motors throughout**
- **Higher-temperature motor insulation, Class B and H**
- **One motor in stock for every 100 of same frame and hp size on the job**
- **Time-lag fuses across the board**
- **Standardizing on a few motor-starter sizes**

SAFETY ENGINEER A P Osti shows Elect Engr W Krauss protective visor to be used by all electricians and production men working near ultraviolet-ray sterile lamps

PLASTIC-WRAPPED flex conduit to end conduit at each motor; wire is RH or TW



THESE THREE STARTERS are hub of starter-standardization plan. They're NEMA sizes 1, 4, 7. Time-lag fuses only are used in all fuse cutouts throughout the plant

used motors. Pfizer has found it best to keep one motor in stock for every 100 of the same hp and frame size on the job.

Motor starters, too, are on short-notice call. To do this, and yet meet all Code requirements, the hub of the motor-starter stock is NEMA sizes 1, 4 and 7. Where possible, starter needs are met with one of these basic three. Reducing the number of types carried and installed simplifies later trouble-shooting.

Time-lag fuses are used throughout the plant for all fuse needs. Result: Motors are fused close to their normal full-load rating. And the time lags take the harmless momentary overloads while popping on sustained overloads and shorts.

Circuit wiring is done in galvanized conduit. No. 12 is the smallest branch-circuit wire size. Type RH is used everywhere except in damp locations. Then it's type TW. But TW is never used underground in hazardous locations. Reason is that solvents may find their way into conduit and literally dissolve the TW insulation.

Plastic-encased, flexible conduit is being adopted for terminating conduit runs at motor terminals. Teamed with the explosionproof motor, combination forms a watertight maintenance-free installation.

Safety department at Pfizer's is rounding out four years of accident cutting under direction of Aldo P Osti, safety engineer. *Safety is considered right at the equipment design and selection stage.* Each set of plans for a new project is studied by the safety department. This department initiated the adoption of safety visor, shown in photo on facing page. Electricians and production folk use this visor when working around the many ultra-violet (UV) lamps in the plant.

Installation methods are standardized where practical. Typical are the motor control centers shown below. They are laid out in neat rows in an isolated motor-control room. That means they are out of the reach of corrosive, and possibly explosive, vapors. And it also means reduced cost since there's no need for explosionproof enclosures. Wiring trough above starter bank eases installation of more starters when needed.

Control centers are pressurized with a slight positive pressure of clean air—just enough to keep dust and vapors from seeping in.

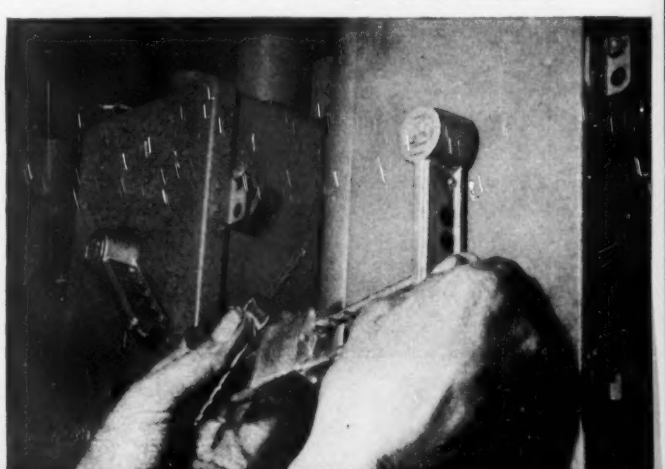
Motor starters are selected with one eye on their locking provision. Where a man is to work on any machine it is first shut down and padlocked. The padlocking program includes equipment driven by an electric motor, steam turbine, steam or gas engine or compartments containing electrical equipment. Key-type bicycle locks are used.

The electrical maintenance family in the Brooklyn plant consists of about 40 men. Each of the other three plants has its own maintenance setup under supervision of plant engineer.

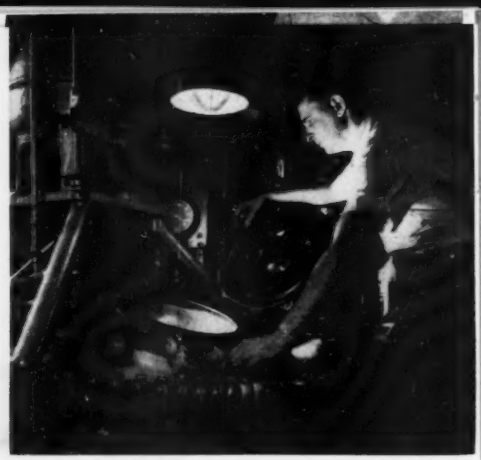
More on next page

MOTOR CENTERS are set off in separate room and held at slight positive air pressure both as safety and maintenance measure

LOCKABLE STARTERS specified—ones that will handle several padlocks at once. All switches locked open before work starts



SPOT MAINTENANCE AREAS are geared for fast trouble-shooting on production units in their zones. Spot-shops save travel time, going to and from main maintenance shop



REACTION KETTLE is typical of those units powered by Class 1, Group D motors

...2-Organizing Men and Methods...

Maintenance work is handled by a *main shop* plus *spot-shops*. Main shop does equipment overhaul and repair. Spot-shops handle front-line trouble-shooting. There are two at present. Spot-shops are designed to avoid having an electrician travel to an outlying building answering a service call. Production time became too valuable. Each spot shop is staffed by a man who becomes well acquainted with the equipment in his area. Trouble calls in these areas are made direct to him. No time wasted with written orders—speed is important.

When a trouble call is received a "guesstimate" is made on parts needed, tools and instruments. Trick is to avoid, if possible, a trip back to shop. These spot-shops are located in the load centers of critical production areas.

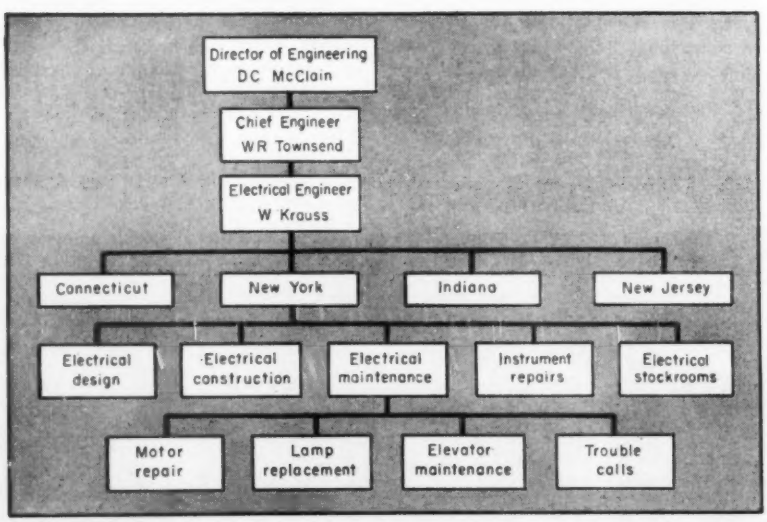
Among the parts carried in spot-shops are fuses, replacement coils for magnetic starters, contacts, thermal-trips, tubes and specialized replacement parts for electronic equipment. Instruments kept on hand are an ohmmeter, megohmmeter, voltmeter and ammeter.

To cut down-time, quick-type disconnects are used on motors, solenoid valves, etc, on critical machines.

Blueprint searching is aggravating and a time waster when a machine is in trouble. If prints are back in the office file, they offer little help to the man shooting trouble. Here the problem is neatly sidestepped by *framing the blueprints right alongside machine.* In most cases the print is a 2-section drawing showing the wiring and schematic hookup. The schematic helps put finger on the trouble area . . . fast.

PRACTICAL FIELD-TESTED IDEAS FOR YOUR PLANT

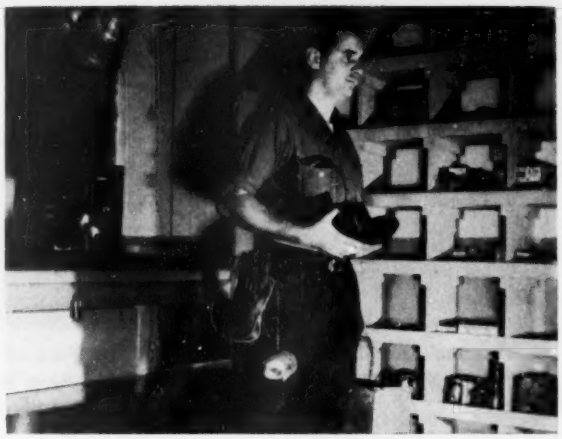
- **Spot-shop maintenance areas close to heart of load**
- **Equip these shops with replacement parts, tools and instruments for efficient on-the-job service**
- **Train spot-shop men for speedy trouble-shooting**
- **Dig blueprints from files and frame alongside machines**



CHAIN OF COMMAND reaches out to include all four plants. Note that all electrical design, construction, maintenance are funneled through plant's electrical engineer

Here's How 'Spot-Shops', Close to Load Centers, Speed Trouble-Shooting

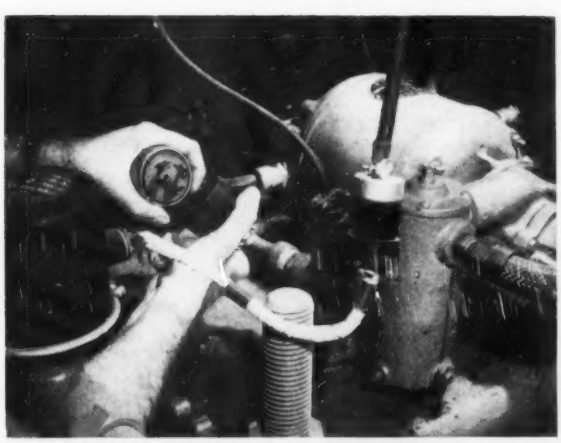
1 Trouble call made directly to electrician in spot-shop by production foreman. Job sped by sidestepping paper work



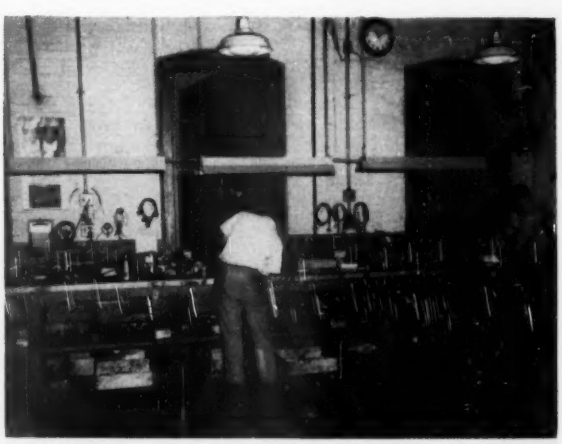
2 Telephoned symptoms, plus good knowledge of machines in area, mean proper tools and parts will be carried to job

3 Here's the machine in trouble. Smooth flow of antibiotics stops; operators are at standstill till machine is repaired

4 After checking symptoms, first stop is at blueprint framed alongside machine. Print combines wiring and schematic



5 Disconnect-plugs ease removal of faulty motor. New motor-pump unit swung in place, plugged in, then back in service

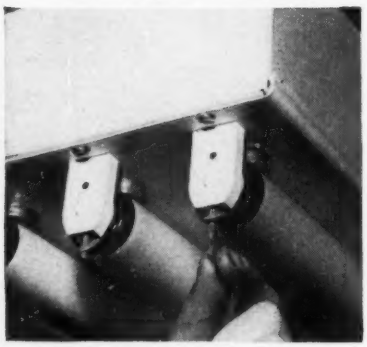


6 Main maintenance shop handles some repairs. But rewinds go to an outside shop, geared for 24-hr emergency service

More on next page

EVERY 4000 HR fluorescent lamps are replaced, fixtures cleaned. This group-replacement plan has cut lamp trouble calls, plus holding the lighting levels high

Safety Is Keynote...



LAMP CLIPS snapped into place at both ends of lamp prevent them slipping out

ELECTRICAL MAINTENANCE *continued*

...3-Adopting Modern Maintenance Techniques

The how-to side of electrical maintenance gets careful study here. For instance, let's consider lighting.

Lamp replacement is handled on a group rather than an individual basis. All fluorescent lamps are replaced after 4000 hr of operation. This is in sharp contrast to the old-fashioned method of replacing burnouts only.

As has been proven in other plants throughout the country, it's false economy to try stretching the last spark of life from fluorescent lamps. They darken at the ends, cutting lamp output, and are limping into the burnout zone after 4000 hr. And consider the time lost on stretching ladders alongside production machines every time a lamp burns out.

What about the lamps removed after 4000 hr? Well about 10% are kept. This is a round figure. Actually, the number will vary since the test is amount of blackening at the tube's ends. Then these 10% handle individual replacements when necessary. Some new lamps in every batch are bound to fail under the 4000-hr mark.

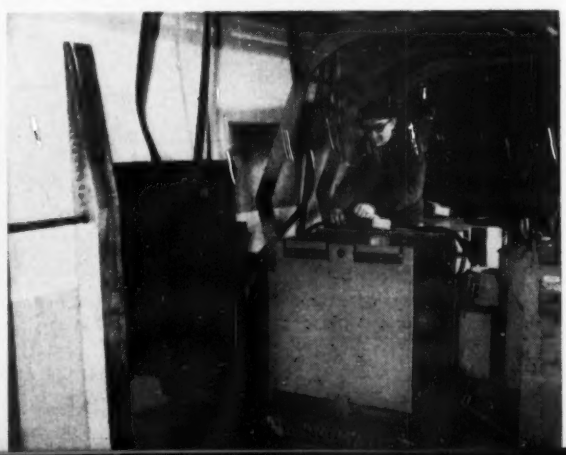
Fixture cleaning in most parts of the plant comes only when lamps are replaced. Other industries, where dirty atmospheres are the rule, need a more frequent cleaning schedule. Incandescent lamps are replaced only after burnout. Pfizer has been using the group replacement plan for over two years and is sold on it.

Then as a safety measure, all fluorescent lamps are locked into position to prevent accidental falling. A simple, 2-piece, fiber locking device is used at both ends of each lamp. Burn-outs are broken safely in a water trough made right in the plant. Cover has three lamp-crushing fins on its under side. By closing the cover with lamps inside, they're smashed in the water-filled tray. Then they are dumped into a drum and carted out.

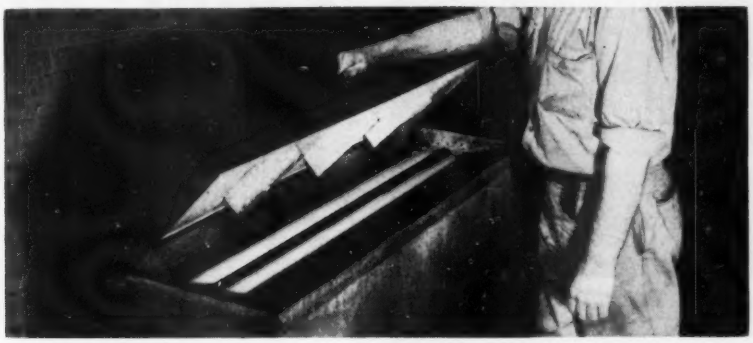
Battery trucks are maintained electrical-wise by the electrical maintenance

INSULATION-RESISTANCE measurements taken yearly on all motors. One megohm is used as a passable, minimum safe value

FORK BATTERY TRUCKS get noon-hour booster plus night charge. Average life for these batteries is seven to eight years



...Of the Modern Well-Planned Plant Electrical Maintenance Program



LAMPS ARE SMASHED under water as safety measure. Removable tray is lifted out when full and emptied into a drum. Patented lamp crushers are also on the market

SAFETY BELT: worn by all electricians climbing straight ladders 10 or more ft

department. Batteries in fork trucks and similar rigs are normally charged at night. But, in addition, they are brought into the battery-charging station at noon each working day for a lunch-hour "snack" charge that carries them through till 5 pm. The electrical department handles replacement of batteries just as they would other electrical devices.

All batteries are constantly rotated. The cycle is tough service, light service, then to the spare rack for trickle charging. Cycle is then repeated. They spend about four months in each service before shifting. Life of the average battery falls between seven and eight years.

Motor maintenance is cut considerably since only explosionproof motors are used. Actually, there's no need to take off the motor's end bells for routine maintenance since the unit is totally enclosed. End shields covering the fan are removed annually or oftener for cleaning. Both fan and ducts are cleaned. Every motor is reached monthly for a lubrication check. The lubrication man is trained to spot such troubles as overheating, leaking bearings, etc.

Each motor has its insulation resistance checked yearly with a megohmmeter. Record is kept on an individual record card. These data are plotted on reverse side of card and if there's a steady drop in insulation resistance with time, the motor is taken out of service. Once a year is often enough because all motors are totally enclosed.

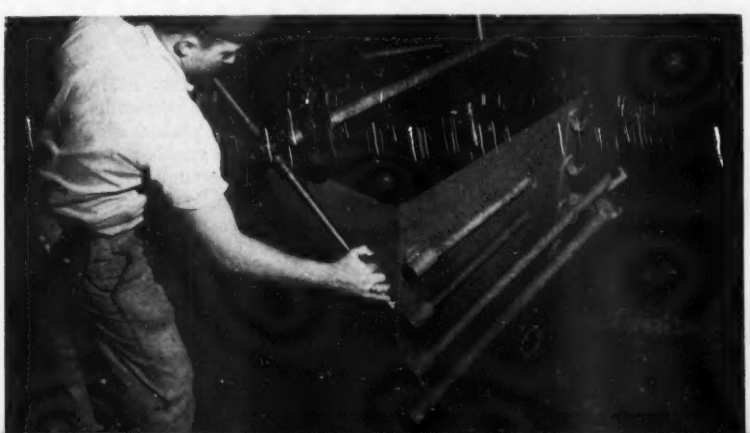
Insulation-resistance measurements are made right at the motor starter. The switch is pulled and a megohmmeter connected between load-line and ground. This procedure means both motor winding and wiring from starter to motor are included in check. Infrared lamps are the first line of defense where a low reading is spotted. Lamps are hooked up and motor baked right on the job. If insulation resistance stays low, motor is removed to the shop. One megohm is considered an acceptable minimum. But the rate of change is more important than the exact resistance. No high-voltage tests are made on plant equipment.

Safety is stressed to each electrician. For instance, every man going up a straight ladder over 10 ft in height must wear a safety belt. In addition, another man must be on hand to hold the ladder. All straight ladders must have safety anti-slip shoes to prevent slipping.

The electrical department is well equipped to handle construction along with maintenance. Glance at the rig shown below. This is a small shop on wheels that can be rolled right to the job. It was designed and built right in the plant.

Each rig is equipped with standard equipment such as an electric hammer, electric drill, conduit hickeys, wire-pulling snakes, etc. The rig is made of 16-gage steel around a framework of 1-in. angle iron.

CONSTRUCTION RIG gives advantages of a true shop on wheels. It's pulled on job fully equipped with electric hammer, electric drill, conduit tools, fittings, etc



SOME HOW-TO TIPS WORTH JOTTING ON YOUR PAD

- **Replace fluorescent lamps on group replacement basis rather than a single burn-out plan**
- **Use safety clips on lamp ends to prevent accidental falling**
- **Make periodic insulation-resistance check on all motors**
- **Remember, "If you are doing it right, you are doing it safe"**

STEAM

Clinic of

► WHEN THE CHIPS are down a good plant operator realizes what he knows will do more to solve any problem he's got than guesswork. That's the theory behind the 25-man Special Smoke and Air-Pollution Committee of Louisville No. 1, National Assn of Power Engineers, shown in top photo. They put know-how to work correcting air-pollution problems in power plants.

Apply

How do they know what plants are violators? How does the local enforcement agency feel about it? Both questions have the same answer. The special Committee and Louisville's chief engineer of the City-County Air Pollution Control Commission, Ralph W Bourne, right in photo, work hand in glove.

Right from the start the Committee

To Solve

The troubled management of a smoking plant is more than anxious to cooperate once it has called in the NAPE. So when the picked Committee representatives (or task-force, as they are frequently called) show up at the plant, bottom two photos, they're given a pretty free hand. In fact, they sometimes

Stubborn

Everything, though, isn't sweetness and light. Once in awhile the task force runs into a plant that's just hopeless. The Committee had to tell one of Louisville's largest manufacturers: "Our collective conclusion is that the proper approach to your plant problem is to retain a reliable, consulting engineer to draft plans and specifications for a more modern plant. But because of the time

Power Engineers...

In 1946, when Louisville put through an air-pollution ordinance that made sense to equipment manufacturers, industry and plant operators, NAPE there voted to pool its resources and help make the program work. Their method —a committee of qualified plant operators drawn from their membership to give on-the-spot technical assistance "for free." They usually get results.

For a typical case of a smoke violator, R W Cooper, power-plant superintendent at Bernheim Distilling Co and NAPE Committee chairman, assigns a task force of three to four engineers from his volunteer group, top photo. Usually they're hand picked for the industry involved. They go out on the job, look it over, note conditions, operating practices, then report back.

The full committee pulls the task-force report apart. (*Editor's Note: This can be a lively session.*) Then they discuss possible solutions, draft a set of recommendations which they forward to the management of the smoking plant. These recommendations usually get the plant out of trouble, often go beyond that and indicate ways of making savings, reducing operating problems.

Know-How...

offered its assistance to the Control Commission. That body had the vision to recognize a good thing when they saw it. Never in the almost three years of the Committee's existence has there been any clash on recommendations, or any question on procedure. A record like that bespeaks intelligent administration on the part of the Control Commission and a clear understanding of the volunteer Committee's limitations and functions. By now the Committee is considered a valuable community aid to closer air-pollution control. There is no question that it is appreciated.

This Committee sticks to power plants, draws its information on offenders from the office of the Control Commission. Then the Committee secretary, Harry Lane, a combustion engineer, (left in photo, left), gets off a letter to the plant managers acquainting them with the work of the Committee, and volunteering help at no cost. The letter is kept factual, points out that the plant and the Committee's findings are kept confidential.

Their City's...

are in danger of being overwhelmed with help.

The men making up this task force have been hand picked for their specialized knowledge of the manufacturer's problems in addition to their understanding of combustion and power boilers. Many times the power superintendent of the offending plant's biggest competitor is a member of the task force. His knowledge of production needs may suggest ways of staggering boiler loads so overloading causes can be reduced or corrected entirely.

One plant manager wrote back to the NAPE, "We are proceeding with the changes mentioned during your visit and hope to completely correct our occasional smoke emittance. Our load has been equalized as much as possible with the present production and has the cooperation of our production department. Thank you very much for your assistance. It was very worthwhile."

Air-Pollution Problems

involved we recommend these stopgap measures. (1) Install overfire air. (2) Establish automatic draft regulator. (3) Provide closer boiler supervision."

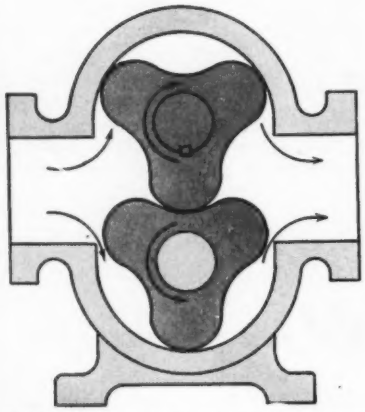
In another plant contemplating modernization the Committee advised: "We concur with your anticipated modernization plan, but unless this work gets under way immediately you have no alternative except to improve your present equipment and install auxiliaries. Grate lengths should be extended about 18 in. to lower burning rates; bridge walls should be relocated to improve furnace volume; air jets should be properly located. Further, your coal storage is exposed to weather and your fuel suffers from a resulting excessive moisture that upsets uniform feeding."

Strong talk? Yes, but it draws answers like this: "The recommendations contained in your letter were very practical and straightforward. We are in full accord with them. As you pointed out, we need a general modernization and have been making primary studies toward that end for the past few months. Incidentally, the overfire air jets you recommended have taken care of much of our immediate problem."

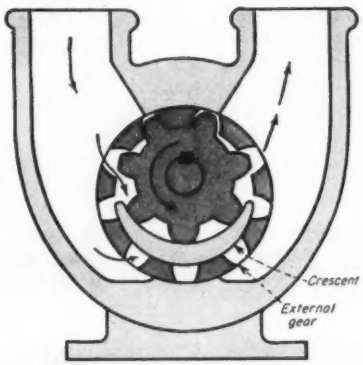
OPERATORS' NOTEBOOK 61

Do You Have Inside Dope

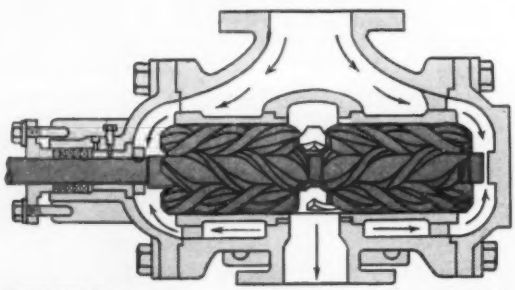
ROTARY feed pump in this tannery plant pinch-hits for old reciprocating duplex



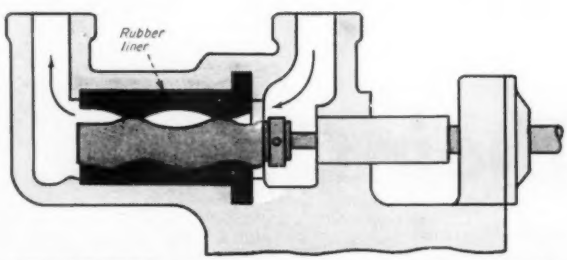
LOBE PUMP is form of gear type, must have gears to drive each shaft, or lobes would slip. Liquid travels around lobes and casing. No valves needed in pump



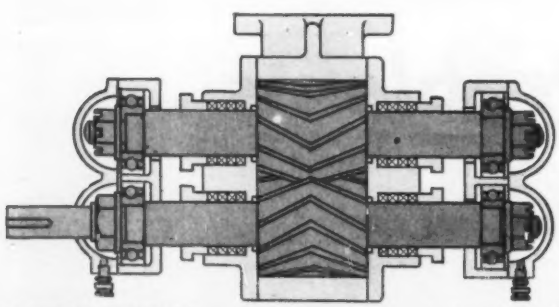
INTERNAL GEAR has stationary crescent to prevent losing liquid back into low side. Liquid from suction fills spaces between the gear teeth as they unmesh



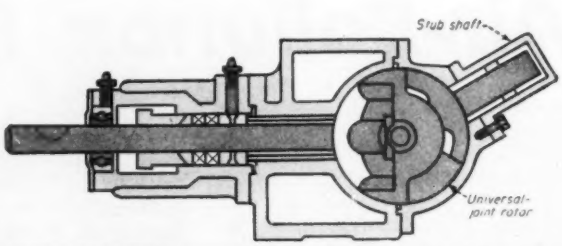
SCREW PUMP has one power rotor and two idlers. Liquid from suction enters at rotor's ends, is trapped by meshing screws and carried along between threads to discharge. Pump works against pressure of 1000 psi while handling oil at 7000-rpm



SINGLE-SCREW pump has one screw turning in double-threaded helix. Rotor is metal while helix is hard or soft rubber, depending on service. Softer helix bears against rotor, doing away with clearance. Use either end of the pump for suction



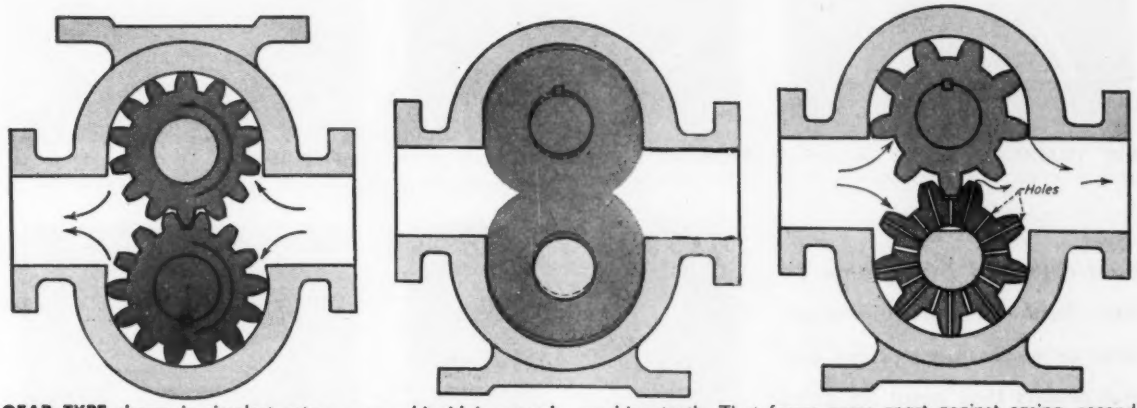
SEPARATE-BEARINGS pump is for abrasive liquids. Helical gears don't build up pressure at teeth ends as spur gear, so holes needn't be drilled. Outside bearings prevent abrasive wear by liquid. Watch shaft deflection by not overloading pump



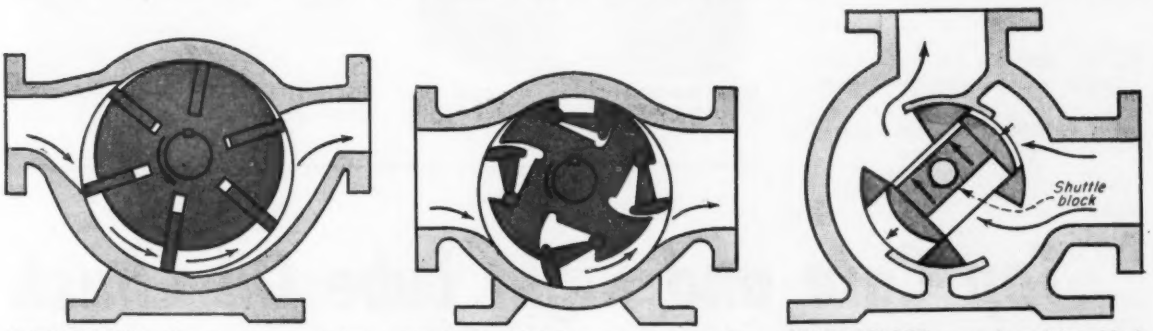
UNIVERSAL-JOINT pump has two shafts connected in casing at angle through universal joint. Joint is spherical and, while revolving, pumps because of closing and opening action of joint. Spherical parts fit snugly, preventing liquid slipping back

on Your Rotary Pumps?

By STEVE ELONKA *Associate Editor*



GEAR TYPE shown is simplest rotary pump. Liquid is moved between gear teeth and casing. Meshing teeth act as valve, preventing liquid sliding back to low side. Trouble is high pressure builds up from liquid trapped between ends of the meshing teeth. That forces gears apart against casing, second sketch. Solution is drilling holes in idler gear, third sketch. Then machine slot in the pin so pressure can escape to high side. Helical gears do not need this change as oil is not trapped



SLIDING-VANE—throws vanes against casing bore. Vanes move out from off-center rotor, sealing casing bore, and prevent slippage while pumping liquid

SWINGING VANE is much like sliding vane but vanes are hinged, and offer less friction. Vane is sturdier; so chance of damage is less if the discharge is closed

SHUTTLE-BLOCK pump has sliding block in rotor slot. Hole in block fits over off-center stationary pin fastened to pump cover, which slides block in the rotor

Rotary and Reciprocating Pumps Are Positive Displacement

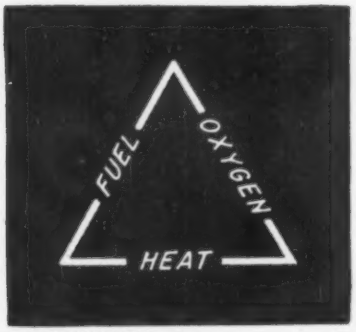
► MOST PLANTS have rotary pumps of one kind or another. These sturdy work horses move oil, water, chemicals and many other liquids. Because they are compact and do their work so well, tendency is to forget all about them until they start giving real trouble. A quick look at the insides of the more popular rotary-pump types will help you understand them.

Principle. Because outside of these pumps resembles the centrifugal type, that's what many people take them for. But they are next in line to reciprocating pumps because both are positive-displacement pumps. The water is not "thrown," as by a centrifugal pump, but actually trapped and pushed around in a closed space as in a plunger-type pump. Rotary type combines constant-discharge characteristic of centrifugal with positive-discharge feature of reciprocating. Only difference from reciprocating is that discharge pulsates with piston, while rotary's discharge is constant. And, of course, one rotates while the other reciprocates.

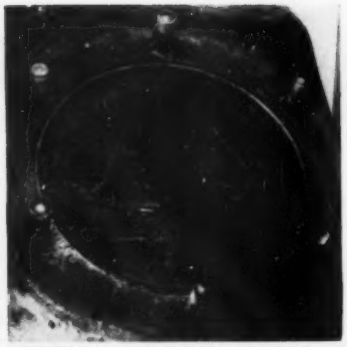
Construction. Casing of all rotary pumps is fixed, or stationary. But insides have tightly fitted gears, vanes, pistons, cams, segments or screws, depending on design. Working parts of most common types shown have two external spur gears; two spiral gears; two herringbone gears; external-internal gears; screws, swinging-vane, 2-lobe, 3-lobe or cam types; special lobe type; guided-vane types, cam and piston; rotary piston; and universal joint.

Maintenance. Packing trouble is cut down to minimum where only low pressure or suction end of pump has packing gland.

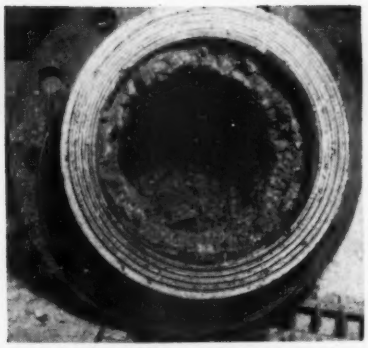
For best results, don't wait until these pumps lose much of their capacity from slippage. Inspect insides at set intervals and check up on clearances that allow liquid to slip.



FIRE TRIANGLE helps you understand what is needed for a system explosion



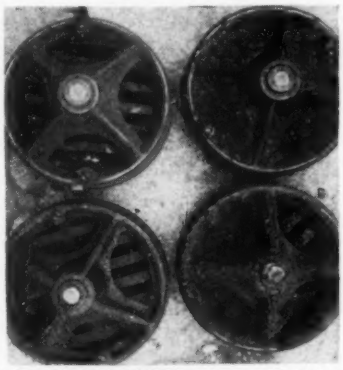
EXCESSIVE carbon buildup found in the valve ports of an industrial compressor



HEAVY DEPOSIT in discharge pipe of air compressor using paraffinic-base lube oil

Poor care and wrong lube oil can lead to air-compressor fires or explosions. Here are test results that point up good ways to avoid trouble in your compressors and air receivers

By **G I TEASLEY**, *Lubrication Engineer*
Carbide & Carbon Chemicals Company
and
B N DUNHAM, *Technical Consultant*
Sun Oil Company



HIGH TEMPERATURE and paraffinic-base oil caused these carbon deposits on valves

DISCHARGE-VALVE cover has excessive carbon deposits that can lead to troubles

Top Care and Right Lube Oil Chase

► FIRES AND EXPLOSIONS in compressed-air systems are rare but can be damaging and fatal. Plenty of reasons are given for fire and explosion causes. But engineers agree on only one. It is carbon formation in system.

Fire Triangle. You've probably heard of this when talking about boilers and furnaces. It's also a help when you study plant air systems.

First side of triangle, above, shows air supplying oxygen, second the lube oil that becomes fuel in a fire or explosion. Third shows temperature rise (heat) during air compression.

Fires occur in compressor discharge ports, piping, intercoolers, aftercoolers and receivers. Since we can't remove oxygen from air we're compressing, we must study fuel and heat sides of our triangle.

Trouble Forms. Fuel for fires and explosions may be one of the following:

1. Vapor from lube oil. More vapor is formed at high discharge temperatures than at low. Vapor-air mixture may be ignited by hot carbon or metal.

2. Liquid oil discharged from compressor cylinders is a dangerous fuel at high temperature. For this reason it's important that you drain intercoolers, aftercoolers and traps often.

3. Carbon that forms on inside walls of discharge ports and pipes is another fuel form. It's also found in grain-like particles in low-velocity piping. It may absorb oxygen, heat spontaneously, ignite.

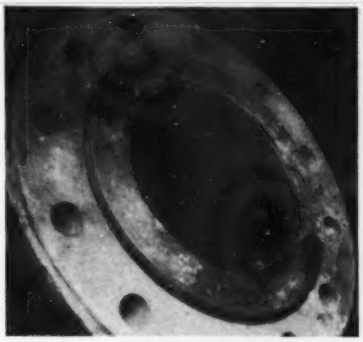
Dust in Intake. Particles of coal, grain, rust, dirt and other impurities entering intake absorb oil vapors and liquid oil. They may even speed the reaction between oil and oxygen, leading to a fire or explosion. So no matter where dust comes from, clean your system regularly. Don't allow compressors in continuous use to run more than a year without cleaning.

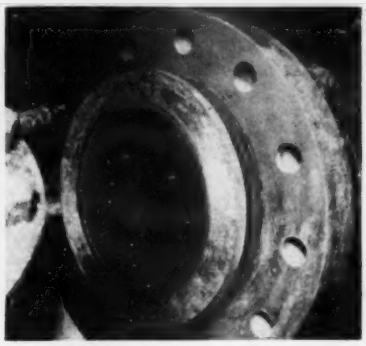
Fuel Side. Forget lube-oil flash point when thinking of explosions. Gases from vaporization or breakdown of lube oil in air system can cause explosions. But for an explosion, you must have just the right amount of oil mixed with the right amount of air at the right temperature.

Temperature needed for an explosion (called autogenous temperature) is high compared with that from air compression. Table, p 119, shows it is above 600 F for oils with a viscosity of 300 ssu at 100 F. Heavier oils ignite at higher temperature.

Use thermometers in your air system so you can always check air temperature. Then there's little danger of excessive temperatures catching you unawares.

Liquid Oil. Too much oil in air system makes carbon build-up rapid, especially at higher temperatures. Rings and discharge valves carbonize and you





Type of Oil Used Affects Carbon Deposits

PARAFFINIC-BASE lube oil is used in this compressor. Note carbon build-up in pipe

NAPHTHENIC-BASE oil used in nearby air compressor keeps the pipe free and clean

Comparison of Lube Oils for Cylinder Lubrication

	Physical Characteristics					
				Viscosity		
Oil type	*Gravity*	*Flash point, F*	*Fire point, F*	*ssu @ 100 F*	*ssu @ 210 F*	*Viscosity index*
Naphthenic base	22.5	350	400	300	47.5	30
Paraffinic base	29.5	430	480	300	52.0	90

	Amount and Type of Carbon Formation				
	Conradson carbon residue	Type carbon formed on burning	Ash, %	% Carbon formation thin film plate, 400 F	Autogenous temp, F
Naphthenic base	0.02	Soft, fluffy	0	11	625
Paraffinic base	0.02	Hard, brittle	0	26	630

Air-Compressor Fires

need frequent shutdowns for cleaning.

Oil discharged from compressor collects in low spots in aftercooler and piping. Here it catches contaminants in discharged air. High air temperatures may also vaporize it. Best way to reduce amount of oil in system is to feed cylinders at rate compressor manufacturer recommends. Give him complete data on your plant before asking for best feed rate.

Carbon deposits probably cause most compressor fires and explosions. Carbon particles get red hot when temperature is too high. Oxygen is attracted to the carbon, even at ordinary temperatures. During decomposition of a carbon-oxygen bond (called a complex), heat is given off. This raises compressor operating temperature, and if carbon ignites you may have an explosion. You can easily see why it's so important to keep compressor operating temperature at right level at all times.

Keep carbon deposits as low as possible. One way to reduce deposits is by using right lube oil for the compressor. Table shows the differences between a naphthenic and a paraffinic oil at same viscosity.

Though a paraffinic oil may have same carbon residue as a naphthenic oil it tends to form a hard, tenacious, brittle-type carbon when burned. This explains why there is rapid build-up of hard carbon on valves when using most paraffinic oils. The higher the oil viscosity, the more carbon formed.

When naphthenic oils burn they form a soft, fluffy carbon much like lampblack. It is easily removed from valves. Discharge air pressure can blow carbon off valves during operation. So you don't have to shut down for cleaning except at long intervals.

Remember, a major cause of air-receiver fires is carbon formation. Best way to avoid this is to use an oil having the least tendency to form carbon. Be sure to use the lightest viscosity oil that does a good job in compressor cylinders.

Heat Side. Reduce heat in cylinder by using a compressor with enough stages for compression ratio desired. Large compressors need more stages for the same compression ratio than do small ones. With stages properly selected for capacity, operating temperatures are safe.

When compressor is right size for plant, all the operator need do is keep overloads down, use correct lubricants and see that cooling-water flow is sufficient at all times. Maintenance men must keep valves, piston rings and cylinder liners in good condition. Water jackets, air filters and pipes need periodic cleaning for removal of deposits formed during operation.

High Temperatures. Carbon forms quicker at high temperatures than at low. Runaway temperatures are caused by leaky or broken valves, broken or stuck rings, clogged water jackets, water failure or air-piping restrictions. When this happens fuel is produced rapidly, and you may have a fire or an explosion. Heat forms the fuel and supplies means for ignition.

Along with fire and explosion hazards we have danger from carbon monoxide gas formed by reaction of the deposits. Avoid breathing this because it can be fatal if too little oxygen is present.

Maintenance. Here are five good tips on how to reduce fire explosion hazards in compressed-air systems:

1. Keep the aftercooler under or as close to the high-pressure cylinder as possible. Oil then flows downhill. More fires occur in risers and horizontal pipes because deposits are thicker. Use enough flanged sections in discharge to clean pipes easily.

2. Clean deposits from discharge pipe at least once a year. Use welding torch to burn carbon off pipe. Burn in a safe place.

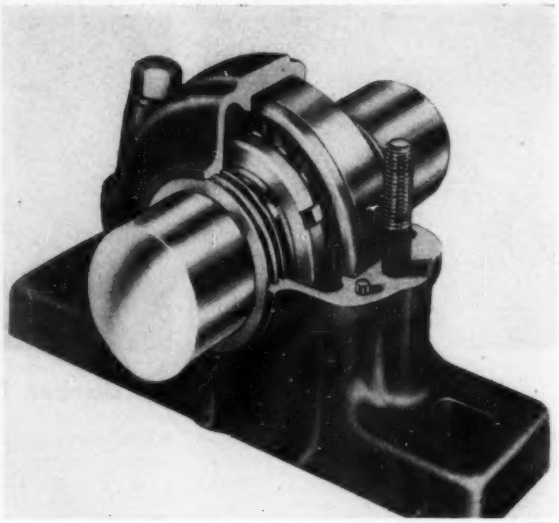
3. Use naphthenic-base lube oils for compressor cylinders. Less carbon is formed and it is soft, fluffy. Blow it into oil trap for removal.

4. Check compressor regularly to see that temperatures and pressures are normal. Check cooling-water flow through jackets, intercooler and aftercooler at least once an hour.

5. Always keep suction and discharge valves in good condition because these are the first to cause trouble that increases air pressure and temperature. Check piston rings regularly; replace when there is excessive leakage. Rebore badly out-of-round cylinders. Inspect discharge valve ports, remove carbon deposits that have formed in them.

Sleeve-type adapters for pillow-block bearings ease the assembly job on long shafting. The tapered threaded sleeve is clamped against the shaft by pressure from the bearing inner race.

Note ease of maintenance with split-housing design. Here are some practical tips on use of . . .



Photos, courtesy of SKF

PILLOW BLOCKS with ball or roller bearings find wide use in main or counter shafting. A power saving can often be shown with ball or roller types where starts and stops are frequent

Pillow Blocks for Long Shafting

► IT'S NOT PRACTICAL on long, standard shafting to use bearings with interference fits. Adapter-sleeve types are generally your best bet. Many industries, particularly paper mills, still use relatively long shafting. Where adapter-type mounting is adopted, regular commercial grades of cold-finished shafting may be used without machining. Friction developed by the press fit of bearing against adapter sleeve is enough to prevent sleeve moving along shaft once adapter and bearing are set in position.

Applications. Like everything else, pillow blocks come in various sizes with different load-carrying capacities. A range of ball or roller bearings are available to fit the same size pillow-block housing. In general, adapter-type units are used on horizontal applications. They may be applied on vertical shafting, but heavy thrust loads can present an additional problem—possible shifting of the sleeve adapter.

Adapter-type pillow blocks usually come in two basic types: *free* and *held*. Free type allows some movement of shaft and bearing within housing. Held type prevents lateral movement of shaft or bearing. Let's look at a typical application, say in a paper mill.

The transmission problem concerns the bearings and their supports for a long shaft, connecting driving unit to driven machine. A little slide-rule work, plus checking recommendations in bearing manufacturers' catalogs, shows there is need for two pillow blocks of a certain size and load-carrying ability.

If two or more lengths of shafting are used they should be connected by flexible couplings. One free- and one held-type bearing assembly should be used. Install the held type at one end and the free unit at the other end. The free type allows limited axial movement needed for normal expansion and contraction of shaft. The held unit prevents axial shaft movement, thereby stabilizing the shaft. If two held bearings were used on the one rigid length of shaft, it might cause premature bearing failure from opposed axial loading.

And where driving unit sets in the middle, with shafts extending out both sides, the same general thinking holds: Use flexible couplings on stub shafts of driver connecting to main shafts. Then use one free-type pillow block and one held-type unit on the intermediate shaft.

Assembly steps for typical adapter-type pillow block bearing appear on facing page. And here are a few additional thoughts to keep in mind. Don't expose bearings to dirt or moisture or remove slushing compound. This compound is a bearing protector and lubricant. After cleaning the shaft, assemble the bearing unit as shown.

When assembling, don't use wood; use a soft-metal drift pin. A hard pin may send off metal chips that find their way into the bearing itself. Likewise for a wood drift.

Lubrication. Grease lubrication is generally satisfactory for moderate speeds. Check with bearing manufacturer on just what are moderate speeds for his bearings. Since grease is essentially a solid, it lodges around shaft openings or in the seals, actually helping keep out dirt.

A good grade of soda-soap grease generally suffices. Naturally the grease shouldn't contain any chemical impurity, free acid, free alkali, dirt, rust. Do not completely fill the housing with grease. This only causes bearing temperature to zoom. Hold grease content to between 1/3 and ½ bearing housing capacity. Have grease supplier tie down exact grease type to use.

Time between regreasing hinges on operating conditions, and grease used. Usually it's best to remove all old grease at least once a year.

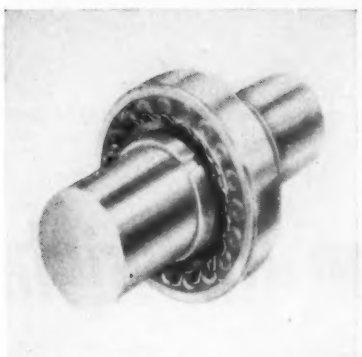
Use oil for higher speed applications. Hold oil level on a line with center of lowermost ball or roller when bearing is stationary. A straight mineral oil is generally satisfactory. Oil viscosity at operating temperature should be at least 70 ssu for proper lubrication.

Nine Steps for Proper Assembly of Split Housing Pillow Blocks

1 First slide the inner triple seal along the shaft to about the final position. Seal slides easily on shaft

2 Then position adapter sleeve, threads outboard as shown. Move to approximate center line with respect to bearing

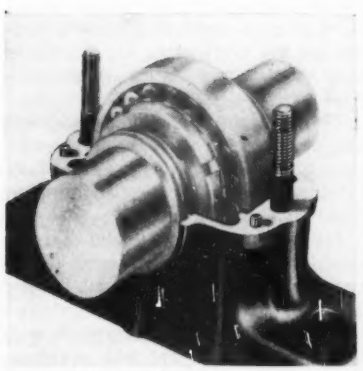
3 Mount bearing on the tapered adapter sleeve, starting with the large bore of the inner race matching adapter taper



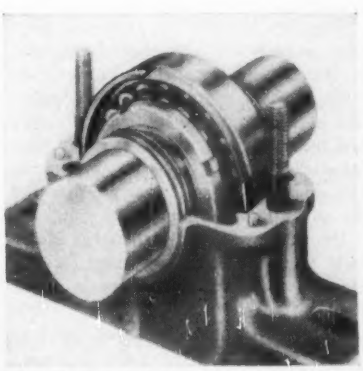
4 Mount lockwasher on adapter sleeve, inner prong of lockwasher toward face of bearing. Slip prong into adapter slot

5 Tighten locknut until bearing moves up snug on adapter, and gives tight fit on shaft. Bend prong into the slot

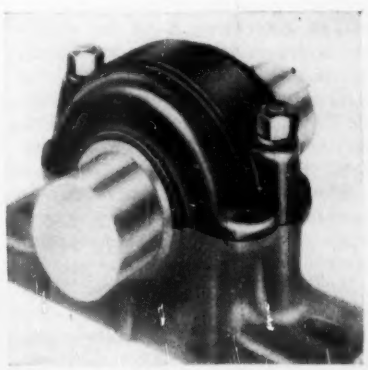
6 Slide outer triple seal on the shaft. Locate both inner and outer seals to match labyrinths in pillow-back housing



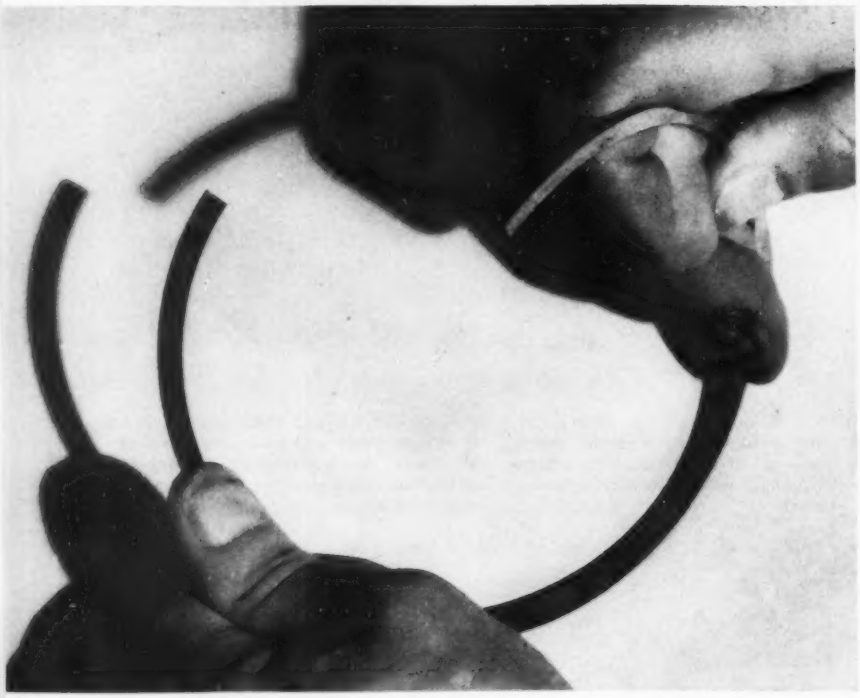
7 Drop the bearing assembly into lower half of housing. Carefully match the grooves of both seals with labyrinths



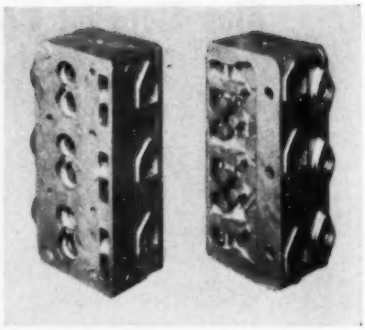
8 Install the stabilizing ring for held type bearing only. Ring prevents any axial movement of the bearing and shaft



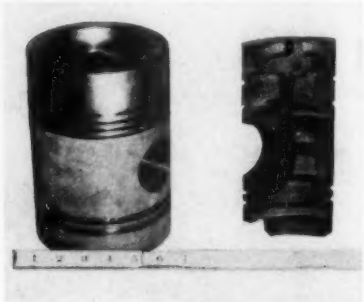
9 Final step is installation of upper half of housing. Take up snug to keep dirt from getting into bearing proper



DUCTILE-IRON piston ring for a diesel engine is easily twisted without snapping into two parts. Cast-iron rings will break when they are twisted this far apart



DIESEL-ENGINE cylinder head of ductile iron has high fatigue, heat resistance



PISTONS for diesel engines can be made of ductile iron. Wearing quality is good

Ductile Iron, a New Design Material,

Only three years old, this new iron is already proving its worth in many diesel-engine and pump parts. Here's a quick look at ductile properties, its many uses in the power plant and industry

► THE HIGH-BROW NAME for ductile iron is spheroidal graphite iron. Some call it nodular iron. But if you're a plant operator, all you need say is ductile iron, and everyone from purchasing agent to design engineer will understand you.

What Is It? Ductile iron contains a small amount of magnesium which eliminates flake graphite, the weakening agent in ordinary cast iron.

Ductile iron is a new iron. Unlike ordinary cast iron it isn't brittle; you can bend and twist it like the piston ring photographed above. Cast-iron ring bent like the one shown snaps, breaking into two parts. Greater ductility leads to better performance.

Can You Use It? You sure can. Ductile is readily available at moderate cost. Its strength is several times greater than ordinary cast iron; it is more ductile, has greater shock resistance. Foundry and machine-shop work are easier than for steel and gray cast iron. When you buy ductile-iron parts you get many of the advantages of steel.

Under stress, ductile behaves elastically like steel. It is now used for production of jobbing castings in many shapes, ranging in weight up to 100,000 lb. Different compositions of the iron are available for various uses. Some use nickel besides magnesium to obtain desired properties for special applications in different types of machines.

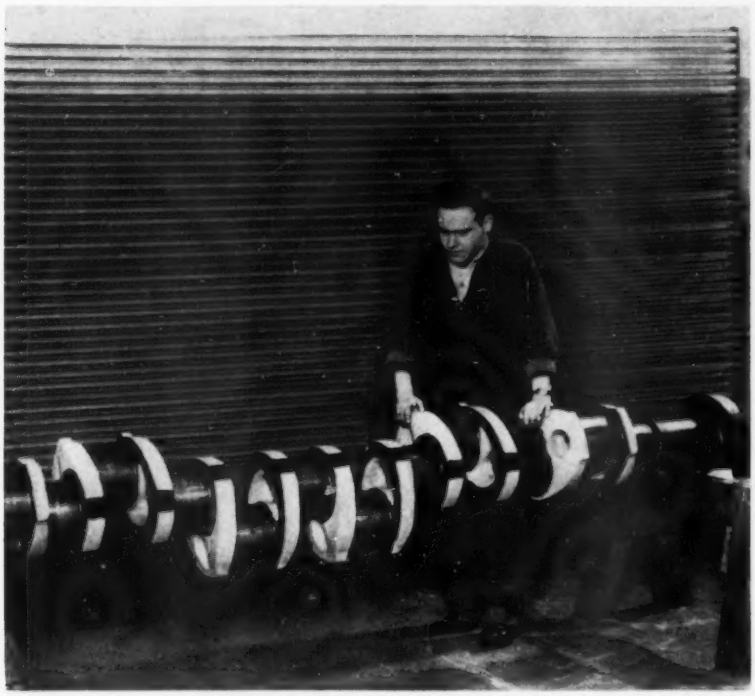
Diesel Engines. To prove how widely ductile iron is used, an entire diesel can be made of it. It will be a stiffer structure than those now made of cast iron. Some diesels distort under overloads, increasing internal friction and cutting power output.

Ductile-iron cylinder heads have much greater fatigue and heat resistance than those of gray cast iron. Failures from fatigue and overheating of heads have been common on some high-output railroad diesels.

Pistons. Large ductile-iron pistons can compete, on a weight basis, with those of aluminum. Ductile pistons have better wearing and heat-resistance qualities than aluminum.

Piston Rings. German and English experience shows ductile-iron piston rings have 100% greater wall tension and 35% better wear life. High-speed European automotive engines do not have lateral flutter met with gray-iron rings running at high speed. Flutter causes early fatigue failure.

Because diesels run at much lower



DUCTILE-IRON crankshafts have same fatigue resistance, better wearing qualities and cost less than steel crankshaft. Several engine builders are studying them

Steps Into Your Plant

speed, the item of flutter probably does not exist. But at 700 to 800 F, ductile iron has properties similar to cast steel. So you can expect it to retain higher wall tensions than gray iron, especially at heavy overloads.

Cylinder Liners. Heat-treated ductile iron has high tensile strength, can be used for thin-walled liners. These increase heat transfer in engines having wet-type liners. Wet-type ductile-iron liners have not yet been built, but engine manufacturers are interested.

Crankshafts. Ductile-iron shafts have same fatigue resistance, better wearing qualities and lower cost than steel units. Casting a crankshaft cuts first cost considerably. For instance, a 2520-lb rough forging is needed to make a finished forged shaft weighing 657 lb. To make a cast shaft weighing almost the same when finished, 637 lb, a rough casting weighing only 700 lb is needed.

It has been said that a casting is the shortest and cheapest route between raw materials and finished product. Ductile-iron crankshafts may show this is true.

Wrought-steel products vary greatly in the efficiency of their material use. After machining, some weigh 50 to 70% of the original ingot. Others weigh only 10 to 20%. With precision casting, like the shell-molding process, we are much closer to our shortest route. Automotive crankshafts that need no machining are made this way. They are ready for service after being stripped from the molds, stress relieved, and ground.

Precision molding of ductile iron can save materials, cut parts cost.

Other Parts. What we've looked over so far are usually large, important parts of a diesel engine. But bearings, caps, valves and pumps can also be made of ductile iron. They show similar desirable properties.

General Uses. Besides diesels, ductile iron cuts right across the power engineer's field. Pumps, gears, tools, valves, pipes, sheaves, shafts and bearing parts are only a few of the many now being made of ductile iron. So if you're considering a new piece of equipment, why not ask the manufacturer's engineer if you'd save by having some parts made of ductile iron? You may be pleasantly surprised.

Properties. Now let's take a closer look at important engineering properties of ductile iron. These give you an excellent lead on where you may use this material for new equipment or parts in your plant.

Ductile iron responds to heat treatment like steel. It isn't particularly susceptible to cracking and can be quenched in either oil or water. Tensile strengths in the range of 150,000 to 180,000 psi are readily obtained, though most popular grade has 80,000 psi with 60,000-psi yield point. Tensile strengths as high as 230,000 psi have been achieved experimentally.

Compositions vary widely, depending on final use. Carbon content of ductile iron is usually higher than engineering grades of gray iron.

Silicon is an important alloying element in ductile iron. Each additional percentage increases tensile strength about 11,000 psi.

Castings. Unusual fluidity of ductile iron makes it ideal for intricate molds. It is said to reproduce intricate mold detail more faithfully than either aluminum or gray iron.

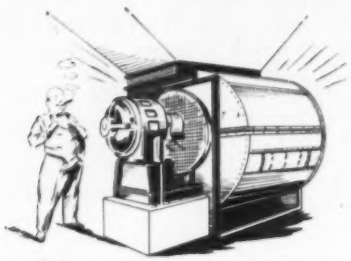
Pressure castings are expected to make widespread use of ductile iron. For instance, the cylinder head for a reciprocating compressor could not be readily cast in steel, and had inadequate properties when cast in gray iron. Ductile-iron head was as good as ordinary cast steel and cost less.

Wear Resistance. Lubricated or unlubricated ductile-iron surfaces have excellent resistance to mechanical wear. When not lubricated, resistance to galling and scoring equals the best grades of gray iron. Tests show ductile piston rings wear as well as the best piston-ring grade of open-grained flake graphite iron.

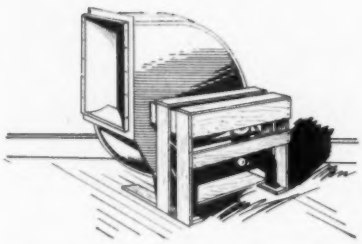
Gray iron gears in one pump handling crude petroleum have a 300-hr service life. Pitting and wear at pitch line are excessive. Ductile-iron gears in the same service run over 1000 hr with no deterioration or pitting.

Ductile iron is easily flame or induction hardened to 550-600 Brinell to give unusually high wear resistance. Heat and oxidation resistance of regular ductile-iron parts is far superior to gray cast iron.

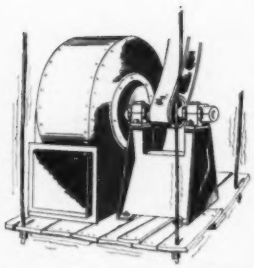
You can arc-weld ductile iron the same way you weld gray iron. Ductile parts are now welded to steel, highly alloyed materials, and to ductile iron itself in the usual way. Welded joints in ductile-iron pipes are stronger than pipe itself though made without preheat or postheat.



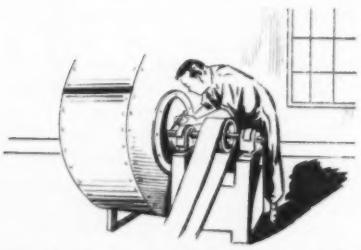
1 Be happy like this guy! Keep your plant's fans in topnotch condition



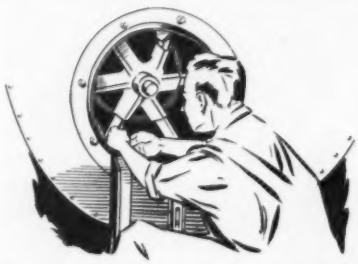
2 Inspect fan carefully for shipping damage when you get it from factory



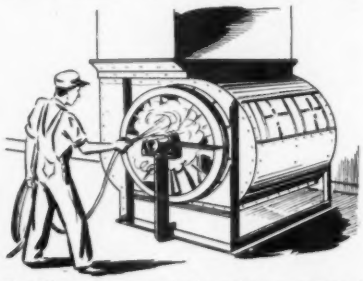
3 Don't mount fan on shaky platform. It shortens fan life, increases noise



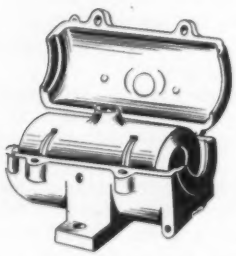
7 To check rotor balance, chalk fan shaft while it runs at rated speed



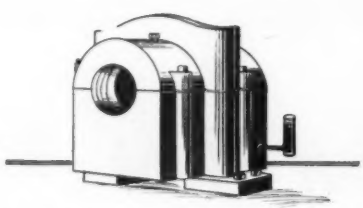
8 Mount balance weight on heel of fan blade. Test until the weight is right



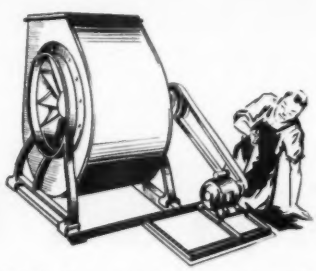
9 Clean fan regularly with compressed air, a scraper or a good wire brush



13 Sleeve bearings like this have replaceable liners for longer life



14 This is a heavy-duty sleeve bearing used where job conditions are tough



15 Don't pry new V-belts into position. Always reduce tension of belt first

Get Better Output From Your Fans With Right Care

By J P HOLTZCLAW
Engineering Service Manager, Buffalo Forge Co.

► GOOD FAN CARE for air-conditioning and ventilating systems starts the day your new fan arrives at your plant. Let's follow one of these units from that first day until it has been on the line for years. We'll see how important right maintenance is for long life.

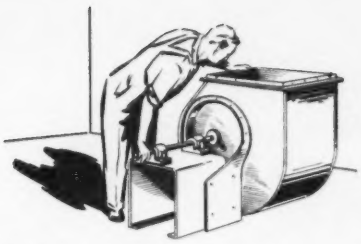
Erection Hints. Carefully inspect new fan on arrival, Fig. 2. Bad bumps during shipment may knock bearings out of alignment, crack lube-oil tubes, put V-belt sheaves or motors out of line. Or parts may be broken though fan is firmly secured in a good crate. Report all breakage, damage and shortages at once to company transporting the fan.

Foundation. If fan is in good condition, set it level on a solid foundation. Don't mount it on a shaky platform, Fig. 3. You'll cut its life, increase running noise.

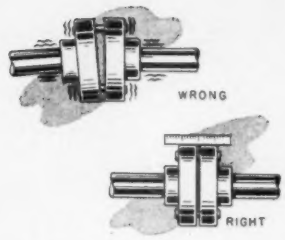
Use manufacturer's foundation drawing. Follow it exactly. Be sure to clean dirt and packing from anchor bolts before tightening fan onto the foundation.

Installation. For small, completely assembled fans, vent and utility sets, mount on a good foundation and check V-belt sheave alignment. That's about all you need do.

With centrifugal fans, clean bearings and fill with oil before start. If bearing liners must be inserted, follow fan maker's instructions. Turn fan by hand before starting. It should revolve freely, Fig. 4. Be sure sheaves are locked in position, aligned and ready to go. Align couplings, Fig. 5.

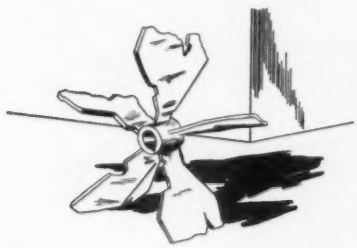


4 Check fan-wheel clearance to avoid striking cone in the fan's housing

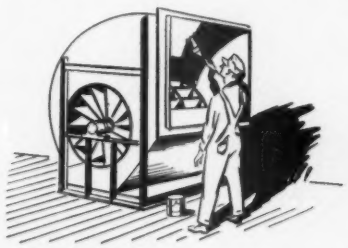


5 Be sure fan couplings are aligned right or you may have serious trouble

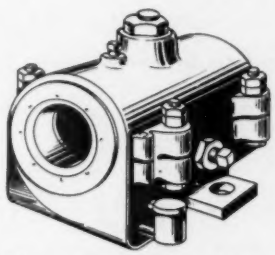
6 Fan balance is like any other kind and is important in good performance



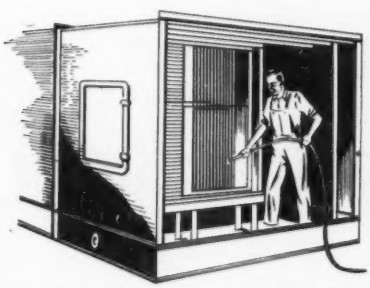
10 Erosion may wear a fan rotor out. Avoid trouble; don't run weak wheel



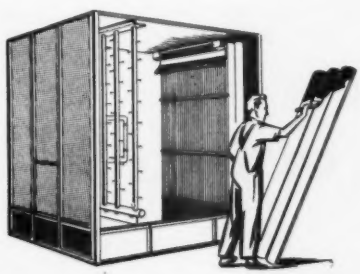
11 Clean and paint your fan regularly. It will last longer and look better



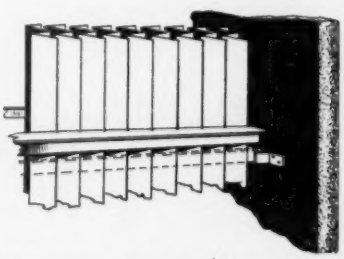
12 This ventilating-type sleeve bearing has long life if properly oiled



16 Clean and flush out your air washer frequently if you want best results



17 Clean and paint air-washer interior at least once a year for best output



18 Eliminator plates are easily removed for the cleaning and painting jobs

Maintenance. Don't overlook balance. Fan handling clean air shouldn't need balancing since job has been done at factory before shipment. But if rough handling, poor foundation or alignment throws fan out of balance, you may have to do the job yourself.

Before balancing, check for bent shaft, tightness of wheel on shaft, bearing condition, foundation bolts and wheel cleanliness. Be careful of bent shaft; it can cause severe vibration and damage.

Chalk shaft, Fig. 7, holding chalk point so it just touches shaft while fan runs. If line runs completely around shaft, fan is OK. If it doesn't, fan needs balancing. Short line means it is badly out of balance. Draw three or four lines on shaft so you can get an average reading.

Make hairpin-shaped trial weights to drive on heel (inside) of blade. Start with weights from, say, 1 to 8 oz; use strap iron or sheet metal, making them in pairs. With fan like that in Fig. 8, run at rated speed and chalk shaft. Stop fan. Long, thick marks show on "heavy" side of fan.

Put a trial weight on blade heel opposite heavy side. Run fan again, marking shaft as before. If marks are longer and their center hasn't shifted from first marks, add more weight on same blade and run again.

If center of mark shifts from that of first run, move weight along blade but keep heavy side in the same place. Continue your tests until line is all around shaft and bearings are steady. Then the fan is in balance. Weld weight to blade. Remember, weld material adds weight to blade.

Cleaning. The dirtier a fan, the more likely it is to be unbalanced. Dirt, dust and grease stuck to blade may change its curvature, affect performance. Clean blades regularly, Fig. 9, using a compressed-air hose, a scraper or a wire brush. Base cleaning periods on amount of dirt in air.

Repair Parts. Don't allow fan parts to wear out. Wheel like that in Fig. 10 could collapse, injuring housing, shaft, bearings or motor. Inspect fan after every cleaning. Most wheels must be returned to factory if reblading or repair is needed.

Painting. Clean and paint sheet-metal housings, Fig. 11, when fan wheel is cleaned. Asphalt or bitumastic paint is good for most ventilating jobs even when moist air is handled.

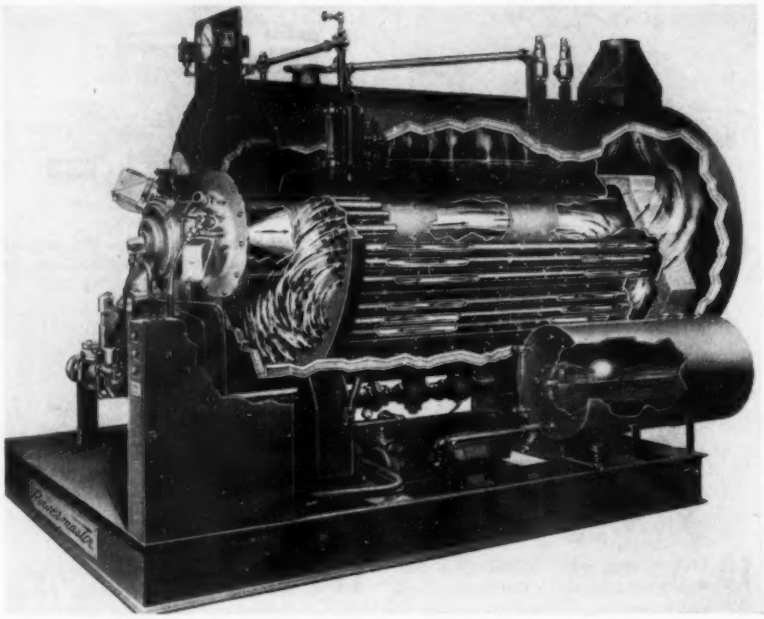
Bearings. Frequency of bearing oiling depends on running conditions. High speeds, bearing pressures and temperatures increase oil consumption. Use only recommended oil grade.

Air Washers. Clean air-washer tanks at least once a week by draining and flushing, Fig. 16. Thoroughly clean and paint interior at least once a year, Fig. 17. Eliminator plates are easy to remove for painting and cleaning, Fig. 18. If you ever have questions on maintenance, consult fan maker.

Packaged Gas-Fired Heating Boiler

Speed-up and more production are the keynotes in about everything nowadays. Chickens now go on a mass-production basis, so do growing plants. Here's how controlled heating coaxes the lowly tomato to go to work throughout the entire calendar year

By **JULIUS KANDA**
Kanda Greenhouses, Cleveland



SECTIONAL VIEW of the automatic, gas-fired, packaged boiler that supplies a controlled atmosphere for ideal tomato-growing plus source of soil-sterilizing steam

► OHIO LEADS THE NATION in growing vegetables under glass. There are now more than 800 acres of greenhouses for vegetable production, and 8200 more under glass for growing flowers and other ornamental vegetation. At the 1952 Ohio Water Clinic* it was estimated the water used in these greenhouses exceeded 60 acre-inches per year. Some appetite for a still-growing industry!

Impressive as this water need is, the industry has still other specialized problems all its own. The major ones are maintaining the proper temperature and sterilizing the soil for the particular vegetable or flower under growth. Both are naturals for a good heating plant. Here is a good example from one up-to-date greenhouse for raising tomatoes.

When the 1902 single-retort underfeed stoker boiler at our greenhouse was ruled no longer safe for service above 15 psi, we decided to go to a fully-automatic heating plant. We put in a 5000-lb-per-hr gas-fired automatic package-unit steam generator, photo, above. It is designed for 50 psi operation and gives us enough steam for a high-pressure supply to sterilize the ground and kill weed seeds between plantings. Let me tell you, it takes plenty of steam to heat a glass-enclosed greenhouse during the harsh Lake Erie winters. What's more, our growing area for tomatoes under glass measures about seven-tenths of an acre, so we've got a heavy heating load.

Heating steam has to be supplied most of the year. We hold inside temperature at 58 F throughout the winter. Then during the milder weather we keep a daytime temperature of 65 F and a night temperature of 62 F. These conditions apply until about July 1.

As you can guess, we asked for and got special safeguards on the boiler installation. We have a pressure switch on it to control a bedroom alarm bell that rings out in case of a nighttime failure. An entire crop can be lost in 30 minutes with a loss of heat during a cold, subzero Cleveland winter.

BOILER OPERATION

Here is how our boiler plant runs. We supply the natural gas available throughout our area (1050 Btu per cu ft) to our new package steam generator. The old boiler stands by, kindled and ready for emergency use, should anything go wrong with our new setup.

This setup features the 3-pass, horizontal, firetube boiler whose workings show plainly in the cutaway above. Flame area occupies a cylinder-like tube in the center of the packaged unit. Combustion products move along under the pressure of incoming gas, about 7 in. wg, toward a rear refractory target wall, through a lower segment of tubes toward the front of the boiler. Then they reverse and move back toward the rear through two lateral sections of tubes to the breeching. They leave the boiler proper at a temperature of about 500 F at full firing rate.

Automatic Controls. As we mentioned earlier, we felt our greenhouse business made it necessary to have a full complement of automatic operating and safety controls. We carried the same idea over into our electrically controlled auxiliaries and power services. All electrical equipment, including motors and controls, is installed and wired into the power and the control circuits. Then all relays, motor-starting switches, overload and short-circuit protection are mounted in a splashproof

*First Ohio Water Clinic, Ohio State University, Feb-14-15, 1952.

GREENHOUSE INTERIOR. Author and his wife are in front of a typical healthy crop. Soil-sterilizing piping runs along the floor, heating pipes run along the side walls

PACKAGED STEAM AIDS FOR GREENHOUSE SERVICE

- Hold greenhouse temperature at 58 F minimum throughout winter months
- Restrict top temperature to 65 F during mild days and 62 F at night
- Provide ideal climate, automatically, and do it within a regulated range
- Sound alarm, day or night, if something happens to the boiler, in time to effect emergency steps to save the crop
- Supply ample source of sterilizing steam to the soil to kill off all parasitic weed growths before new seedings and plantings take place

Extends Old Sol's Growing Season

steel cabinet at the right side of the operating platform, photo facing page.

The automatic firing sequence is well thought out and highly reliable. (*Editor's Note: See Automatic-Fired Boiler Precautions, this issue, p 92.*) On startup we have the air blower come on first for a purging period. Then the gas-electric pilot comes on. After the pilot is established the gas valve opens and if ignition takes place, the pilot kicks out. If the pilot does not take hold for the proper period, a flame-sensing device prevents the main gas valve from opening.

The burner, too, carries several safety precautions. For instance, the burner can start only if it is in the low-fire position. An interlock in the air-supply damper prevents the burner from starting unless the damper is in the low-fire position. What's more, the burner has a calibrated modulating control that proportions air to fuel for peak combustion efficiency over the 30-100% load range.

Low water cutoff, electronic flame scanner, forced-draft-fan failure or excess steam pressure have special connections wired into the burner circuit so the burner automatically cuts off on a signal from any one of them. To the burner this information appears as an operating defect and so the unit shuts down to allow clearing or correcting the fault in safety.

The feedwater cycle similarly came in for all possible precautions. An automatic boiler feed system is located on the right rear of the boiler base, photo, facing page. It consists of an atmospherically vented condensate receiving tank for both city water makeup and heating-system condensate with a motor-driven boiler feed pump.

PROCESS PROBLEMS

The jobs of soil-sterilizing and atmosphere-heating that the boiler does are very interesting. In fact, the sterilizing phase puts a real test on the boiler. We take the full 50-psi output and directly condense it in the soil through porous tiles buried in the soil. In the photo above showing interior of the greenhouse, you see the feed pipes to these tiles. When the steam goes into the soil it's lost forever and the boiler operates on a 100% cold makeup. This sterilizing goes on, a bay at a time, between planting seasons.

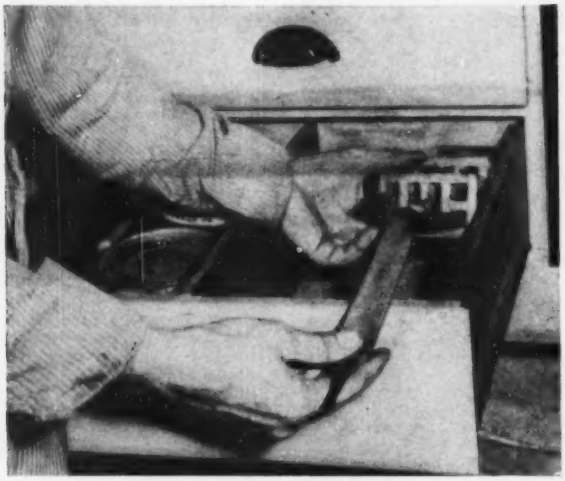
When the sterilizing operation is in full swing we cover the soil with tarpaulins and push in steam to raise soil temperature to about 212-215 F, and then hold it there for 4 to 6 hr. What we do to determine proper soil temperature and be sure it's been held long enough is to put a raw potato on the ground under the tarpaulin. When the potato is cooked the soil is considered sterile and ready for the next planting.

The tomato plants themselves are raised from seed. The seedlings we transplant several times to increase root strength. Then they are arranged for the last time in what we call the production stage. We guy them vertically, photo above, to overhead trusses. When the plants reach the full height of the guy wire we turn them downward and they keep on growing.

When the time is right for pollination we tap the plant stalks lightly. This is one place where Mother Nature needs a helping hand. Because there are no air currents or pollinating insects within the greenhouse we have to substitute this tapping action. When the fruit's ready for harvesting we pick the tomatoes, sort them and place in baskets for direct sale in the Cleveland market.

Our controlled climate will let us reach this market more often.

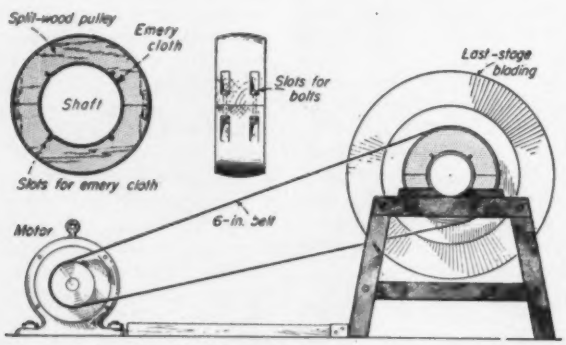
PRACTICAL IDEAS...*here's the trading post for your*



Store Files To Protect Edges

IN MANY SHOPS the job of storing files is a problem. In maintenance department tool cribs, files are sometimes laid across pegs or in individual racks. More often they get thrown together, thus losing teeth or dulling their edges. A simple but effective way to store files is shown. Make a small plywood pigeon-hole box hinged to the back of a drawer. In this way files are easy to remove or replace, yet remain separate and sharp. Whatever method is used, separate the files.

G F BURNLEY *Oakland, Calif.*



Polishing Scored Shaft of Turbine

DURING PERIODIC internal inspection of our 18,800-kva turboset, we found that shaft (where it passes through gland on exhaust end) was badly scored by carbon sealing ring. Job was to polish this rough section before new carbon rings were fitted with right clearance.

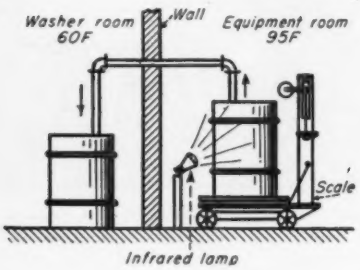
As time was limited, and no suitable lathe to take large spindle, we had to improvise rig, sketch.

We found a 20-hp dc motor. Its speed could be controlled by resistance. I scrounged only available belt from another department and had a wooden split pulley made on short order, 8 in. larger in bore than shaft. We fitted it with emery cloth as shown.

Assembling whole rig with motor and spindle securely blocked, we slowly (and with apprehension) started the motor. Shaft began rolling OK.

Oiling liberally, we moved revolving pulley endwise to cover length of rough surface, also to prevent scoring, turned spindle at intervals against rotation of pulley. To insure roundness we changed emery cloth frequently. As the job progressed, we gained confidence and applied pressure to belt to secure maximum grinding. Motor was also speeded up. Job turned out to be excellent, besides saving time and expense.

V STROJSA *Glace Bay, Nova Scotia*



Separating Oil and Freon

BECAUSE LABYRINTH SEALS in our Freon centrifugal compressor for air conditioning were bad, Freon mixed with circulating oil. So every month we had to extract gas from cooler and replace with new gas.

Here's how we separate gas from oil. We have cooling washers besides conditioning equipment room, in which are located centrifugal compressor (300-hp motor) and air compressor (60-hp motor) for cleaning. In equipment room, temperature is high, 95 F, whereas in washer room, it is only 60 F.

We placed drum of oil-and-gas mixture on a weighing scale in air-conditioning room, sketch. Then we connected this drum with a ¾-in. pipe to an empty drum on other side of wall, inside washer room. Heat makes Freon boil in drum and condenses in drum in cool washer room.

We determine amount of oil in mixture by weighing a sample of mixture, then we weigh just the oil in sample after all gas boils out. By using this method and weighing drum, we know when process is finished.

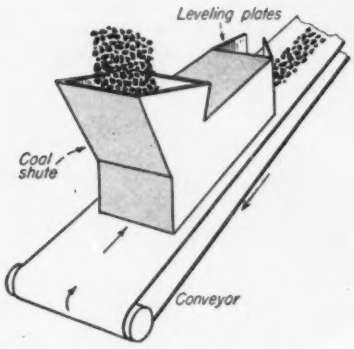
To speed boiling, we shine four infrared lamps on drum in air-conditioning equipment room.

System is so successful we have saved about $2000. Now we have new seals, and oil mixing with gas is reduced to a minimum. This operation is simple.

E QUINTERO *Bauta Cuba*

operating and maintenance short cuts

STEVE ELONKA, *Associate Editor*



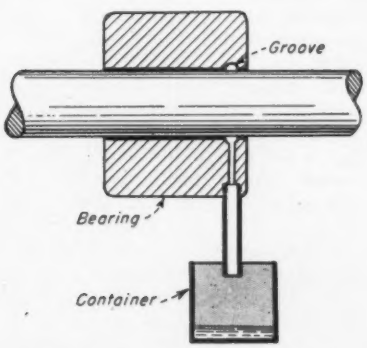
Plates Adjust Coal

COAL IS DUMPED into chute, sketch, by a double shaker. We could never set shaker completely open because too much coal dumped on belt at one time. Then coal would roll off.

We corrected this by welding two leveling plates at end of chute as shown. Plates are at an angle to restrict coal dumping on belt. They are of ⅜-in. plate iron, and welded to chute.

Because we store a lot of coal in summer, this improvement saves us about three weeks each summer, as shaker is now run full speed, without spilling coal. Plates could be made adjustable.

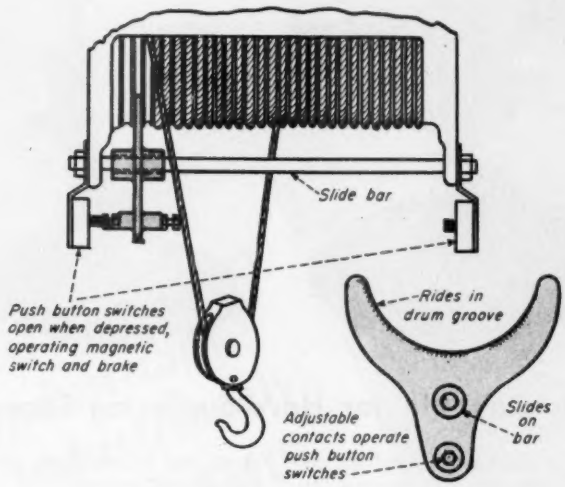
L J COLLEN *Clinton, Iowa*



Shaft Oil Leakage

OIL LEAKED along a motor shaft but we stopped it by cutting a groove in the bearing, sketch. Grove is cut around the bearing's entire circumference and is placed about 3/16 in. from the bearing's end. A drain hole drilled in groove's bottom is connected to a ⅛-in. pipe. Oil creeping along the rotating shaft is thrown by centrifugal force into the groove, then drains off into container. No more wasted oil now.

T H CARR *Shipley, Eng.*

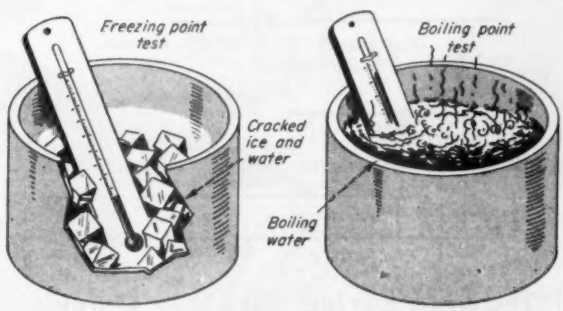

Slide bar
Push button switches open when depressed, operating magnetic switch and brake
Rides in drum groove
Slides on bar
Adjustable contacts operate push button switches

Limit Switch Protects This Hoist

MOST ELECTRIC HOISTS, especially the monorail or hooked-up type, have a trigger arm, which is tripped by the rising hook that has a switch for instant stopping and brake operation. This prevents overwind, but does not take care of equally dangerous condition of a loaded hoist running out too far or slipping anchor end of hoisting rope. So we made our own improvement.

Sketch shows a foolproof design I fitted to a 5-ton hoist. It gives positive control to desired limits of hoisting and lowering. Stretching hoisting rope does not interfere with original setting and adjustment. It's also compact, not affected by swinging load and there's no chance of missing or fouling lower hook block, etc. We wouldn't be without.

F C SALTER *Vancouver, B.C.*



Testing Thermometers In Your Plant

AT TIMES you have to know if an ordinary wall thermometer is accurate. A simple check is to submerge the thermometer's bulb end in an open-top container, partly filled with cracked ice and water, as shown. If the thermometer reading drops to 32 degrees and remains there, the thermometer is reasonably accurate.

To test the boiling point of a hot-water thermometer, heat a container half full of water until the water boils. Have bulb end of thermometer submerged below the water's surface but a couple of inches from the container's bottom. If temperature reading of the thermometer reaches 212 degrees and remains there, thermometer is accurate.

T TRAIL *Catonsville, Md.*

(*Continued on page* 130)

More PRACTICAL IDEAS

Begins on page 128

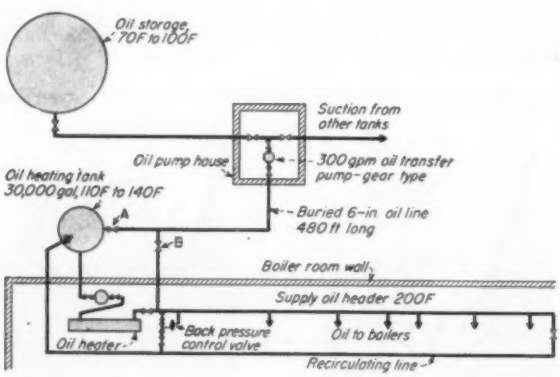
Holding Rig for Hard-Surfacing Screws

WE HAVE A NUMBER of screw flight conveyors in our plant. To increase life, we hard-surface outer wearing edge. But hard surfacing in place is a slow and unpleasant job.

As conveyor flights are delivered to us fabricated in single turns, our plant welder made holding rig shown to hard-surface them individually, before making complete conveyor. This makes job easier and besides work can be done during slack periods.

Upper holding jaw, with its sleeve and adjusting screw, can be lifted off for placing flight in position. Holding jaw setscrews hold jaw solidly in position. Adjusting screw maintains correct pitch, or corrects pitch if it's not right. Tool can be used on work bench or floor.

J A SWANSON *Princeton, B. C.*



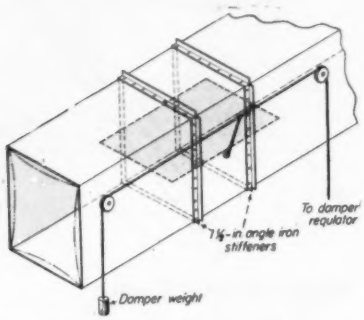
Thawing Buried Oil Lines Quickly

IN PLANT using oil as standby fuel, long supply line to heating tank was buried in ground. There was no way of warming line. Oil, used seldom in cold weather, congealed in buried line. Then oil-transfer pump would stall and trip out.

Hot-oil supply was kept circulating inside boiler room for emergency use during cold weather. We made 1-in. tap on supply header to boilers and connected to 6-in. filling line for small heating tank, sketch. To start burning oil, valve *A* was closed and valve *B* opened. Then oil at 200 F would flow under full header pressure into 6-in. line and displace congealed oil.

Gear-type transfer pump slowly turned backwards as cold oil was forced out of line and into storage tanks. In about 30 minutes, congealed oil would be replaced with hot oil. Then transfer pumps could be started. Time might have been shortened by using a larger line than 1 in. to introduce hot oil. Same idea applies to system using reciprocating pumps. But then you need a bypass around pumps because reciprocating pump won't run backwards.

J R MISENHEIMER *Tulsa, Okla.*



No More Sticking of Smoke-Flue Damper

A NEW PLANT, not yet accepted by owner, had trouble with main damper in smoke flue sticking. Safety valves would blow or steam pressure drop. Fireman was busy opening and closing main damper.

Heating and ventilating contractor shut down boilers and cooled smoke flue. Then he disconnected damper regulator chain and weight from damper. His man went into flue to find cause of sticking. He reported damper free in all positions. Also that there were no seams or rivets to interfere with it. Boilers were started and again damper stuck.

We thought lower pressure inside flues (due to draft), caused atmosphere on outside to force large flat surfaces of flue in and thus seize damper. Theory proved correct when covering was stripped from flue and straightedge used.

Dotted lines at smoke flue's end exaggerates condition, sketch.

We corrected with 1½-in. angle iron, riveted on flues outside in two bands near damper, as shown. Countersink rivets made a flush job on inside of flue. Damper worked fine.

J W BLAKE *New York, N. Y.*

Use Adding Machine

SMALL, PORTABLE electric adding machine is valuable accessory for chief operator's office. Solves totaling requirements, and forms easily checked printed record. It's quickly moved to any job site for calculations.

L FITZPATRICK *Jefferson City, Mo.*

(*Continued on page* 132)

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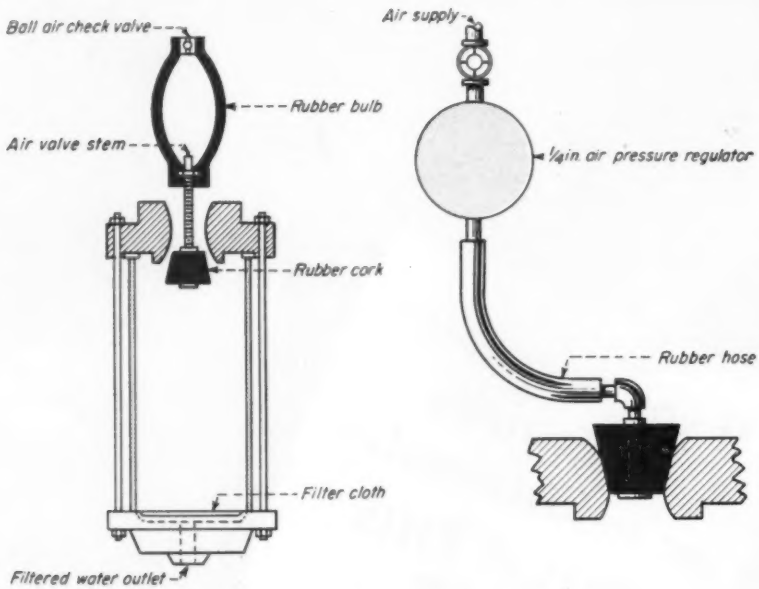
nalco WATER TECHS*

*Few men interested in water technology and practices have time or opportunity to read all the published articles and technical papers which deal with the industrial aspects of water treatment and use. To help overcome this difficulty, *Nalco Water Techs* will provide a listing of carefully selected articles and papers which are reprinted by Nalco in pamphlet form for free distribution upon request by interested readers. Your requests will involve no obligation whatever . . . This addition to Nalco advertising is being undertaken solely as a further Nalco contribution to the better understanding and use of modern water technology.

More PRACTICAL IDEAS

Begins on page 128



Boiler Sample Filtering Made Easy

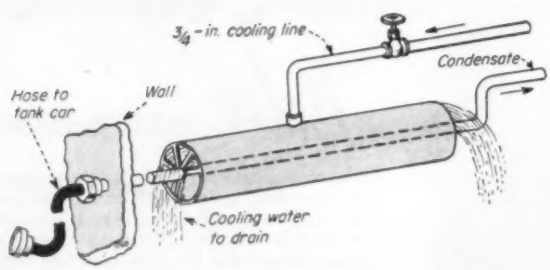
WE FILTERED boiler water samples before testing on all boilers every two hours around clock. A hand-pressure filter was used, but it took a lot of hand pumping. When pulling cork up into place, air bulb would pull off, and cork and valve fall into sample.

I simplified the filtering by mounting cork on valve stem as shown in sketch. I took out valve stem and attached to compressed air. Then I set regulating valve so I felt just a little air coming through outlet. Cork is inserted as in stoppering any bottle, and air pressure builds up in filter chamber.

Pouring sample into filter was also simplified because valve stem, which couldn't be removed, on hand-operated filter was done away with by pressurizing it with compressed air. Constant air pressure on sample filters the entire sample. But with hand pressure, complete filtering required additional pumping to filter a large sample.

Elimination of these little troubles, in connection with routine testing, made the job easier on tempers. Also there is a not-so-rough attitude toward breakable water-testing equipment.

C WERDERITCH *Montgomery, Minn.*



Removing Condensate From Tank-Car Coils

CONDENSATE in oil tank-car heater coils causes ice, slush and mud under and around the car. Also steam and dampness form in gutter inside plant. Because we couldn't have oil in return condensate line (even with an oil separator in system), we made condenser, sketch, from an old pipe 2½ in. by 6 ft.

We used regular creamery hose from steam coil of tank car. With proper fittings, it's connected to a ¾-in. pipe inside building, where it runs to sewer. Slip 2½-in. pipe over the ¾-in. line at its end. Center pipe and weld or braze spokes in each end so about 75% of openings are restricted. This insures outside pipe being full of water.

At 6-ft pipe's center, place inlet from ¾-in. water line. Flow is controlled by a valve. Run condensate line up so that condensate line is also full. That provides most cooling surface. Condensate cools enough so no steam escapes. Our condenser has been used for the past two years.

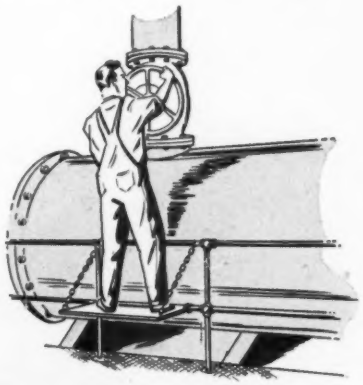
A L THILQUIST *Montgomery, Minn.*

Fixes Gasket Seat

ONE OF OUR DIESEL ENGINES has wet liners and lapped seat for a copper gasket for each liner. We found liner seat eaten out where it had been welded at a previous overhaul. Weld had been made to build up seat, which also had eaten out. Damaged portions were overgrown pits; one quarter of an inch across at biggest diameter.

Because the weld did not hold, we got another idea. We drilled a hole through each pit, reamed it out with a tapered reamer. Tapered pin was driven into hole long enough so it would not quite bottom, with enough sticking out to fit casting surfaces. Thus no part of pit was open to further corrosion. After lapping in liner, the pin became practically invisible.

D L COCHRANE *Cambridge, Minn.*

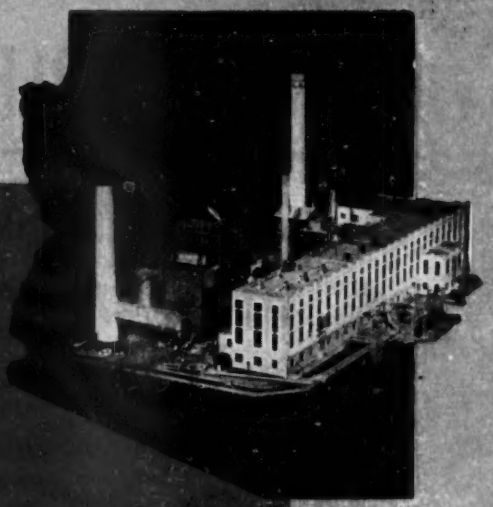


How About Putting Up A Folding Platform?

INSTEAD OF DRAGGING a short ladder around to get at those "just out of reach" places, why not put up a folding or disappearing platform? It is handy in narrow aisles. We reach some controls on top of a 48-in. pipe by supporting a piece of floor plate on a hinge and chain. When not in use, it's latched out of the way, back against the rail.

G LINDGREN *Troy, N. Y.*

ALSO IN ARIZONA, IT'S YARWAY



PUBLIC SERVICE PICKS YARWAY UNIT TANDEMS

FOR 920 PSI BLOW-DOWN SERVICE

Arizona Public Service Company—operating in the youngest, but one of our fastest-growing states—is another prominent utility that relies on Yarway Unit Tandem Blow-Off Valves to guard its boilers. In fact, *4 out of every 5 high pressure boiler plants are Yarway-equipped.*

Such popularity had to be won. It was—by offering good design, careful engineering and manufacturing, modern metallurgy and dependable service.

Yarway engineers, conveniently located near you, are constantly working for better, more profitable steam plant operation. Need help? Call a Yarway man.

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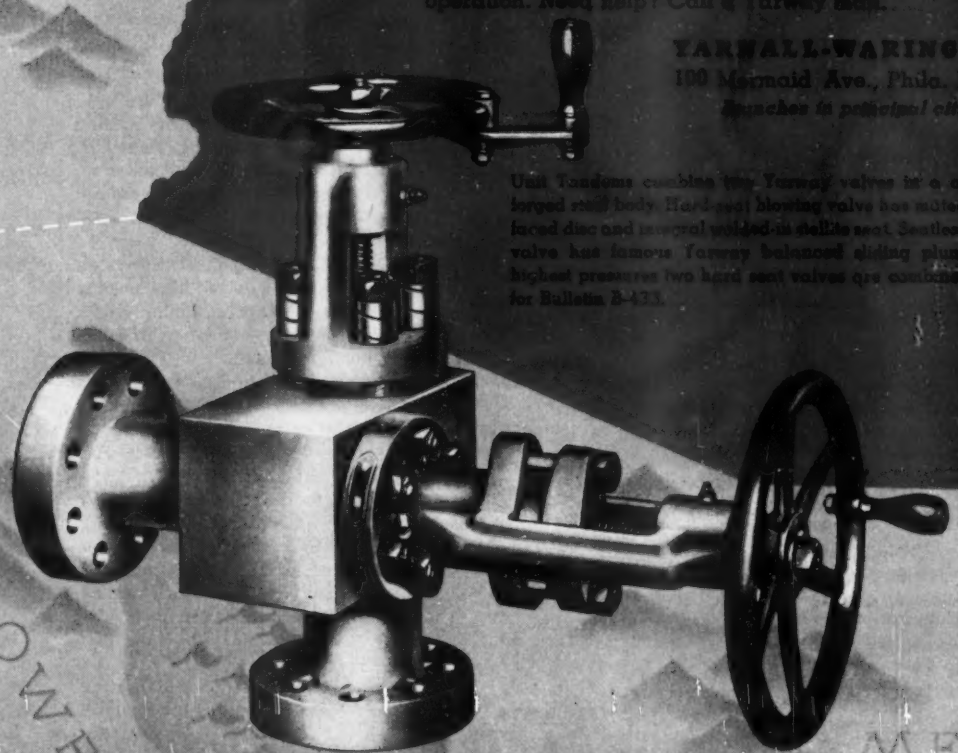
Unit Tandems combine two Yarway valves in a one-piece forged steel body. Hard-seat blowing valve has mated stellite-faced disc and integral welded-in stellite seat. Seatless sealing valve has famous Yarway balanced sliding plunger. For highest pressures two hard seat valves are combined. Write for Bulletin B-433.



YARWAY SERVICE GOES ALL THE WAY....

PLANT PROBLEMS . . . *put your know-how to work*

How Shall I Set Up Heating Records?

HERE ARE THE FACTS: I run a large coal- and oil-burning heating plant having eight boilers. We heat 20 buildings, housing 4000 people.

With such a large heating load, plant efficiency, fuel costs and weather conditions are important. Management keeps a close check on our expenditures and I'd like to be able to show them why and where every dollar is spent.

How do you set up records that correlate weather, fuel consumption, plant efficiency and other factors? What are best data to collect? Are records worthwhile if they require much work to set up and keep in order?—*CB, Nov Power*

Here Are the Answers

Boiler No.

Date	Time	Outdoor Temp, F	Steam to Distribution: Press, Psig	Steam to Distribution: Temp, F	Steam to Distribution: Flow, Lbs.	Feedwater: Press, Psig	Feedwater: Temp, F	Feedwater: Flow, Lbs.	Boiler Losses: Blowdown, Lbs.	Boiler Losses: Others, Lbs.	Coal: Consumption Lbs.	Coal: Btu Content	Coal: Unburned in Ash, Lbs.	Boiler Eff, %

KEEP RECORDS on a log sheet set up especially for your plant load

HERE'S OUR LOG for keeping heating-plant records. Operator makes hourly check of plant to get his readings. You need a meter in blowdown line to record flow, coal scales and means to find unburned coal in ash if you use this form. Also, no auxiliaries or heaters use boiler steam and all heating-system returns are reused.

Log can be set up to run from 7 am to 6 pm if plant is banked during evening. If it isn't, leave spaces for an entry every hour during day and night.

A J Breugelmans *New York, N.Y.*

RECORD KEEPING is simple once you line up your facts and formulas. The most important quantity in heating-plant operation is amount of steam generated. A flowmeter on main steam header is a must if you're to compare system costs over a period of time. Flowmeter on each boiler is better because from its reading and fuel consumption you can easily figure boiler efficiency.

Use either a steam flowmeter or a meter in condensate-return line for each building. Latter is good only when all heating-steam condensate is returned to the system.

Use degree days to figure fuel consumption. Set up a list with which you can figure additional steam output needed for unusual weather conditions. By doing this for one of our plants we found that when outdoor temperature dropped from 40 to 30 F, steam load rose 4000 lb per hr. When outdoor temperature falls from 20 to 0 F, load increases 15,000 lb per hr.

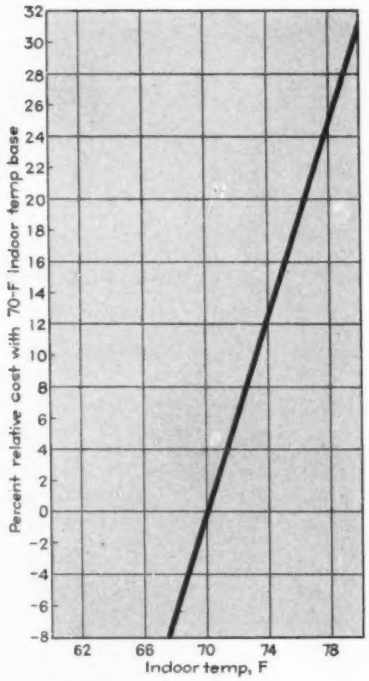
Accurate steam demand figures not only help you keep closer tab on boiler efficiency, but they are also a good guide to condition of traps and regulators in the return system of your plant.

L W Fitzpatrick *Jefferson City, Mo.*

DON'T OVERLOOK instrumentation of the heating plant. It saves plenty in fuel. Also, keep accurate records of plant's fuel, steam and water consumption.

E W McKnight *Memphis, Tenn.*

For your new problems from Power readers, turn to page 138



BE CAREFUL not to set up a record system needing more work than its results justify. With only a heating plant *CB* can start his records this year and continue them several more years to obtain a base for future estimates and comparisons.

Don't overlook mechanical aspects of heating. These include building insulation, reducing leakage at windows and doors, unnecessary use of ventilation during heating season.

In one plant we found manufacturing personnel opened doors and windows to reduce temperature during winter. Warm air escapes from building and thermostats call for more heat. Desired temperature reduction can be obtained by shutting off radiators and saving fuel. Automatic control of heating system can bring sizable fuel savings and reduce amount of maintenance needed for equipment. Savings are more important than ever today because fuel costs are rising.

Chart shows relative cost of heating comfort for various temperatures above and below 70 F. Keeping indoor temperature at 80 instead of 70 F raises operating costs about 31%. If you keep indoor temperature at 68 F it costs you about 6% less to run plant than when indoor temperature is 70.

L A Howe *Rock Island, Ill.*

help the other guy cure his headaches

TYLER HICKS, *Associate Editor*

TRACK DOWN heat in your plant the same way you would dollar bills. Then you'll be able to get along better with management. Here are a few tips that work well for me.

On your daily weather report to management, show (1) the weather—type, wind force and direction, temperature, degree-days for day and accumulative for heating season (2) heat needed for system (3) steam used (4) boilers in use and time they've run (5) fuel consumed and its cost (6) system efficiency.

For each building heated list (1) indoor temperature and difference between indoor and outdoor temperatures (2) heat theoretically needed (3) heat actually delivered to building (4) "building" efficiency = item 2 ÷ item 3. Data for all buildings are entered on single sheet. From this the heat data for daily management report are compiled.

Also, keep daily boiler log where you record all important operating facts. See POWER, April '52, pp 132-136 for several typical examples of boiler logs.

With these data a financial report is prepared. It shows cost of supervision, labor, fuel, supplies, depreciation. From this you can figure heating cost on a Btu basis, or any other desired.

If management requires accurate heating records you must have good instruments at all important points in your plant. Fit each boiler with its own steam-flow recorder and install another one on the steam main feeding the heating system. Where more than one building is heated install an automatic steam-flow controller and recorder in each building.

With good records, it is easy to track down causes of excessive fuel consumption. Some of these are abnormal weather, heavy winds, and standby losses on days with widely varying outdoor temperatures.

W H MILLER *Lancaster, Pa.*

USE DEGREE DAYS as your base for figuring fuel consumption. You'll find that total number of degree days for a particular month do not vary much from one year to the next. So if fuel consumption during a given month is considerably higher than in the previous year, check the month's degree-days first. If they are about the same as the previous year, look for the reason in the boiler room or heating system. Plot of fuel consumption is also helpful.

G E BOYHAN *New York, N.Y.*

Computation for Steam-Heating Charges

From April 1 to April 25

Item	Quantity	Unit	Unit cost	Total cost
Coal	502	Tons	$7.79	$3910.58
Water	5885	Cu ft	0.60/1000 cu ft	3.53
Ash removal	2	Cars	54	108.00
Engine-room labor	—	—	—	2254.19
Track, 2-hp motor	119	Kw	0.013	1.54
Bucket, 7½-hp motor	448	Kw	0.013	5.82
Conveyor, 10-hp motor	595	Kw	0.013	7.75
Stoker, 5-hp motor	1186	Kw	0.013	15.42
Maintenance labor	51	Hr	—	85.19
Boiler-room supplies	—	—	—	30.83
Total				$6422.85

	Lb steam consumed in month	Cost per 1000 lb	Total cost
Building A	2,268,220	1.373c	$3114.71
Building B	2,409,080	1.373c	3308.14
Total	4,677,300		$6422.85

Charge Breakdown

	Percent prorate	Total cost
Chicago house A	65.2 Bldg A	$2030.79
Headquarters A	29.6 Bldg A	921.95
Scott Burr A	1.3 Bldg A	40.49
Advertising A	3.9 Bldg A	121.48
Building B	100 Bldg B	3308.14
Total		$6422.85

DAILY RECORDS are summarized at end of month and entered in the form above. Total cost is easily and quickly figured. Use degree days as a base when unusual weather causes trouble.

FRED WHYTE *Chicago, Ill.*

When Can I Tighten Manhole Bolts?

HERE ARE THE FACTS: One of our boiler plants has ten 7440-sq-ft 5-drum 220-psig watertube boilers for standby service. They are run for about a week at 30-day intervals.

Drum manhole gaskets are made of woven asbestos fabric. They are elliptical, 12x16 in.

When we start fires under the boilers, gaskets compress and manhole bolts expand because of temperature rise. At times small leaks show up at the gaskets.

I've proposed having the operator tighten manhole nuts after the boiler is up to pressure. Some of my men question this, saying it is unsafe. What do *Power* readers do about this problem? Is it unsafe to tighten nuts with full pressure on boiler? What's the best way to stop leaks at gaskets?—*FA, Nov Power*

Here Are the Answers

MIX WATER with graphite before applying to gasket. This prevents carbonization of oil on gasket seat, which leads to leaks. This scheme gives me good results. Faces need little if any scraping when renewing gaskets for the manhole.

It's quite safe to tighten nuts while boiler is under pressure.

HARRY DIXON *Port Alice, Can.*

(*Continued on page* 136)

More PLANT PROBLEMS

Begins on page 134

GOOD LIGHTING makes manhole and gasket maintenance easier for you

ONE PLANT I know of has excellent safety standards. Only low-voltage lighting is used when working in boiler drum on manhole seats and other parts. This protects crew from shocks.

NEAL OLMSTEAD *New York, N.Y.*

DON'T WORRY about a bolt letting go. Temperature isn't high enough to cause a loss of strength. Nothing serious is likely to happen if a bolt does let go. Boiler pressure will usually hold manhole in place.

I've seen a stud stripped in one plant and one break in another during tightening, but in neither case was anyone injured. There was only a mild steam leak around the manhole. Other stud and dog kept manhole in place.

P D HOBSON *Ontario, Canada*

USE NEW GASKET every time you take a manhole out. Then if you have a leak, you'll know trouble is in seat, not gasket. Never use an extension on wrench when tightening nuts.

D H MARSHALL *Greenwood, Miss.*

SPECIAL GASKETS may be *FA*'s answer. Those having crimped continuous-wound stainless steel with alternate layers of asbestos may be the answer. They cost a little more, but soon pay their way.

I like to tighten nuts just before taking a boiler out of service. If operators are busy they can let this chore go until they have time, just so long as they tighten nuts while boiler pressure is still above atmospheric. Open drum and superheater vents to prevent pulling a vacuum. Leave vents open until steam blows through them on next start-up.

Never allow operators to try to stop gasket leaks by sledging, hammering or using a wrench with an extension while pressure is on boiler. Take boiler out of service if leak can't be stopped with a standard-size wrench. Install a new gasket when boiler is out of service.

ART BELTON *Montreal, Can.*

I TIGHTEN nuts whenever there's a leak, even if boiler is under full pressure. I snug up the nuts just enough to stop leak, being careful not to put too much strain on the bolts.

GEORGE MILBURN *Stratford, Can.*

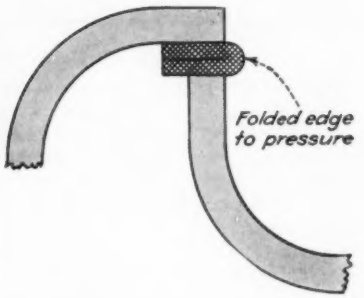
BOLTS DRAWN UP snugly prevent cover from shifting. For best results, clean manhole and cover thoroughly before tightening. Snug up the nuts two or three times during boiler warm-up. Soaking gasket in water helps it conform to exact shape of manhole.

HOWARD HOLCOMBE *Los Alamos, N.M.*

DON'T WASTE TIME and money shutting down a hot boiler to replace a leaking gasket. Use a new gasket correctly seated after all repair jobs that require manhole removal. Have both seats smooth and clean.

L W FITZPATRICK *Jefferson City, Mo.*

TURN TO page 138 for your two new problems from Power readers



DON'T TIGHTEN BOLTS while boiler is at full pressure. *FA* will find normal boiler-operating pressures and temperatures squeeze compound from asbestos and compress asbestos.

To prevent small leaks we use new gaskets with fold toward pressure, as in sketch, every time plates are removed. We carefully center plates when replacing them and tighten bolts alternately with 24-in. wrench.

During boiler warm-up we take up slack in nuts with a 12-in. wrench. During more than 34 years around boilers I've heard of only one manhole gasket blowing out. This was in the steam space of a Scotch marine boiler. Graphite had been applied to both sides of gasket. It blew out while pressure was being raised on the boiler.

R E FONTAINE *Kenmore, N.Y.*

SAME TROUBLE pops up in our plant as in *FA*'s. Main point to be stressed here is that no one is strong enough to push manhole off its seat while boiler is under pressure.

Manholes in our plant have been so loose the dogs could be spun, but they didn't leak under pressure. This happened after manhole was put on cold, tightened cold, then tightened again with half full pressure on boiler. As I see it, the only reason for tightening nuts is to keep dogs tight.

Check bolt to see it has enough threads to allow nut to be fully tightened against the dog. Clean threads each time nut is removed and run it down to end with your fingers.

M E RULE *Princeton, N.J.*

TIGHTEN BOLTS when boiler pressure is about 30 psig. If any gaskets begin to sputter, go back and tighten nuts some more. Don't put it off until boiler is up to full pressure, or until tomorrow. Never use a pipe wrench or hammer when tightening up nuts. You may regret it plenty if you do.

J M GORRIE *Richmond, Va.*

(*Continued on page* 138)

No Pressure Wipe-Off on Gears Lubricated with Sun 897 Grease

Even heavy tooth loading won't cause Sun 897 Adhesive Pressure Grease to squeeze out. It stays on the gears, prevents metal to metal contact, prolongs gear life, and reduces lubrication costs. Sun 897 is most valuable where *throw-off* with resultant wear and spotting of products must be avoided. It is easily applied with a brush on open gears, sprockets, chains, slides, cams, cables, couplings and linkages. For complete information, consult your nearest Sun representative or write Department P-2.

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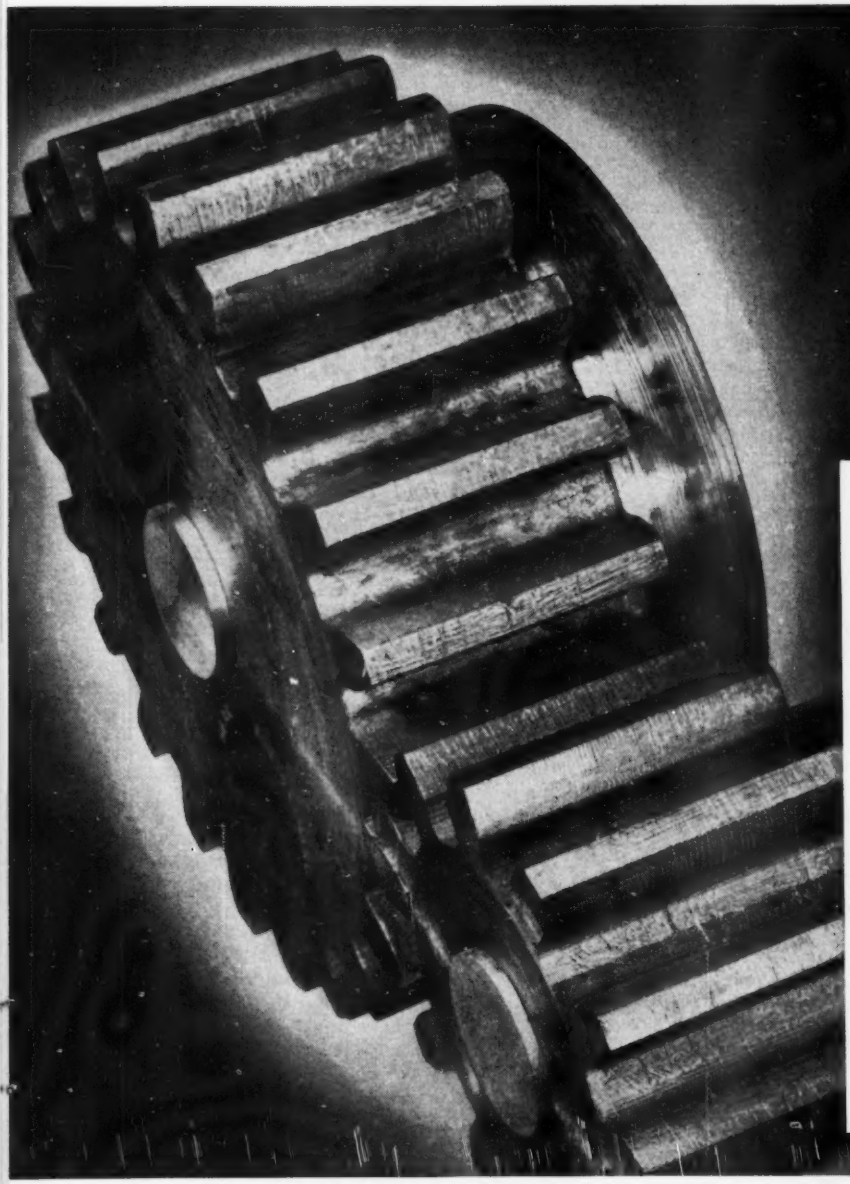
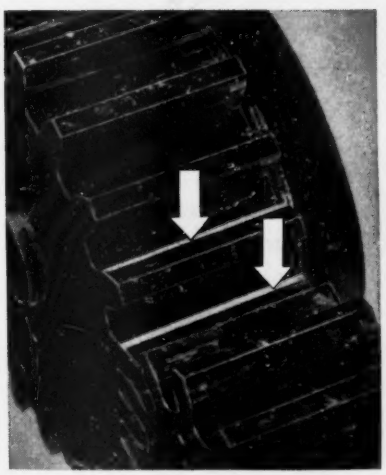




BLACK GEAR COMPOUNDS oxidize, harden and wipe off quickly under pressure. Arrows indicate where wipe-off of the compound has left the gears unprotected by a lubricant. Metal to metal contact causes excessive wear and thus materially shortens the life of gears.

NO SQUEEZE-OUT due to pressure. A thin, transparent film of Sun 897 Adhesive Pressure Grease stays evenly distributed on the gears and gives positive lubrication at all times. Sun 897 is water resistant and can be easily applied with a brush.

More PLANT PROBLEMS

Begins on page 134

I TIGHTEN NUTS with full pressure on the boiler. I've never felt it was unsafe. If gasket leaks badly, take boiler off line and allow it to cool. Drain enough water so manhole can be worked on.

Install a new gasket after cleaning bearing surfaces. We usually coat our gaskets with a mixture of cylinder oil and graphite. Seat gasket evenly all around and pull up nuts evenly. Start fire after filling boiler, and wait until there's full pressure in the drum. Then tighten nuts again.

C H Elbert *Irvington, N.J.*

CLEAN BEARING SURFACES before renewing gaskets. This is the most important step in the job. Draw up nuts on all manholes after running hydrostatic test on boiler. Draw them up again when boiler pressure is close to normal. When boiler is out of service and not carrying pressure, you can draw up nuts again.

A A Hunnewinkel *Woodstock, Ill.*

RUN HYDROSTATIC TEST before firing boiler. Water pressure should be about one and one-half times normal steam pressure, temperature about 150 F. Tighten manhole nuts until all leaks stop.

After test, raise steam pressure slowly. Leave air cock on drum open until all air is purged, then close it. Manholes won't leak if you've tightened them correctly.

Taking up manhole nuts with hydrostatic pressure on boiler is safer than with steam because if anything blows you'll only get wet instead of scalded. It's the most sensible test.

Open air cock as soon as you shut down boiler. This prevents a vacuum in drum, which may cause leaks in piping valves and joints.

L E Polikoff *Brooklyn, N.Y.*
Edward Delnick *Brooklyn, N.Y.*

SERIOUS ACCIDENT in our plant taught us that waiting until boiler had full line pressure was wrong. We now start taking up slack when boiler pressure is 25 psi, and continue at intervals of 50 psi until line pressure is reached.

Fred Tronsen *Milwaukee, Wis.*

SOME ASBESTOS GASKETS shrink if stored for long periods. This changes contour. Stretch gaskets by hand before installing on manhole.

Check how much nut is pulled up by measuring stretch of manhole bolt. You can figure stretch needed or obtain it from a table of bolt properties. We make our final pull-up with a few psi on the boiler and get good results.

G E Boyhan *New York, N.Y.*

USE MIRROR to examine drum seating surface from outside. Smooth any burrs with emery cloth. Deep nicks require grinding of seating surface with special equipment that allows grinding wheel to follow manhole contour.

Don't use gaskets more than once. Use dry graphite on both faces of a new gasket to prevent sticking when manhole is removed. Pull up manhole nuts when boiler is cold and as soon as leak appears after you start to raise steam on the boiler.

If no leaks appear, pull up nuts hard when boiler is at line pressure. There's no danger in this practice. *FA* may have better results with spirally wound gaskets. Use them dry or as the manufacturer directs you.

J J Geist *Brooklyn, N.Y.*

OTHER READERS sending answers, which we omitted because of lack of space, are the following:

A H Moulton *Pittsfield, Mass.*

A J Breugelmans *New York, N.Y.*

YOUR TWO NEW PROBLEMS FOR FEBRUARY

1 What Causes Feed-Pump Vibration?

Our 4-stage boiler-feed pumps are designed to handle 650 gpm of 300-F water at 2400 rpm with 209-ft suction head and 1193-ft discharge head. Head developed by pumps was to be 984 ft.

First pump vibrates seriously at speeds between 2150 and 2200 rpm. Second unit developed same condition after running a short time. Third pump now does the same after running well for three years.

Balancing drum and shaft sleeves on No. 3 were badly worn when we opened it. Replacing them hasn't done any good because pump still vibrates.

Our operating conditions are not the same as design values used. Suction head is 225 ft, discharge head 1035 ft.

What causes this vibration? How can we stop it now?—*BP*

2 How Many Men for Maintenance Work?

Within about a month our new industrial plant for manufacturing chemicals will be ready to begin production. It has close to 4000 electric motors ranging from fractional to 600-hp units.

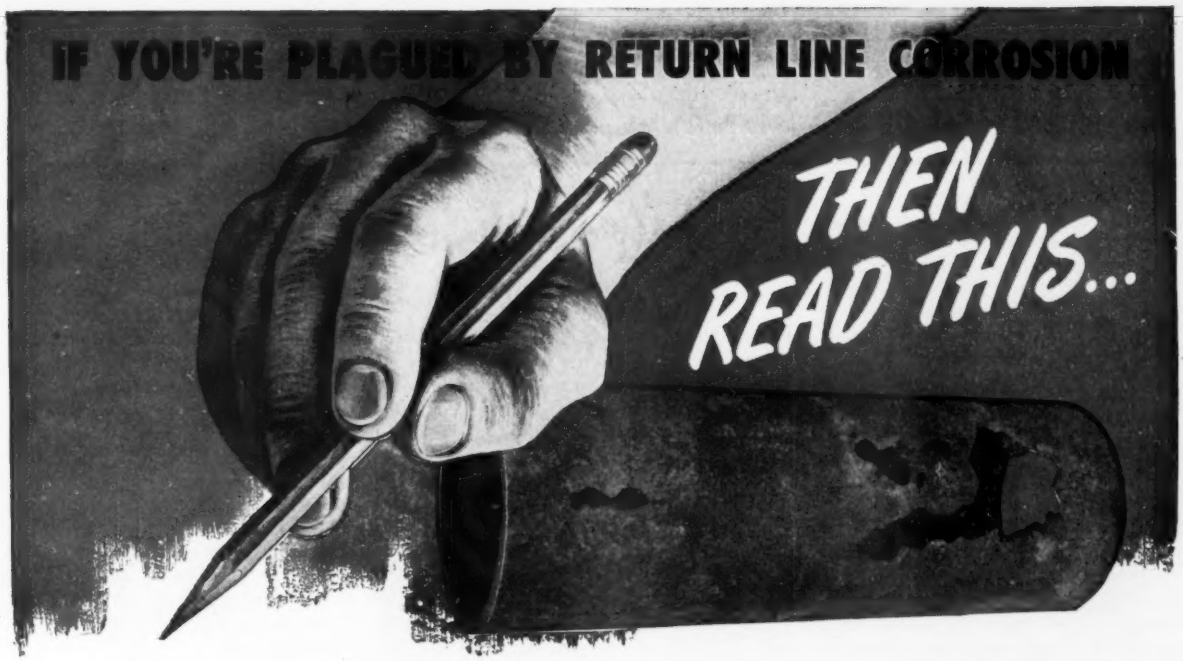
Right now I am planning my maintenance crew for electrical work. We will do all ordinary maintenance jobs, but will send out heavy coil-rewinding jobs.

Besides these motors we will have modern lighting throughout the plant, several elevators, complete alarm systems for process vessels and numerous automatic controls.

In planning my department I'd like some help from *Power* readers in choosing the number and type of men. How many foremen do we need? How many master electricians and helpers? What's the best way of finding number of men needed for each job?—*KL*

Don't miss next month's problems. Another chance to use your ingenuity

Will you help readers who sent us problems? Extra pay for photos or sketches



As an engineer responsible for efficient, economical plant operation, you know only too well that corrosion of steam and condensate lines can send costs skyrocketing through pipe replacement, interrupted production, and increased labor and maintenance. Perhaps you, like many other engineers, have tried stop-gap methods to check the problem only to find them partially effective or far too costly.

Realizing the importance of this major industrial problem, Betz Laboratories has developed its patented filming amine treatment. Here, at last, is a simple, inexpensive, and practically 100% effective method of eliminating this costly and production-disrupting headache.

For example, a linoleum company, operating at 150 psi and producing 300,000 pounds of steam per day, employed sodium zeolite softening for a high bicarbonate raw water. The carbon dioxide content of the steam averaged 40 ppm. Continued maintenance was required due to failure of condensate lines from the steam kettles and unit heaters. After the filming amine treatment was applied, maintenance records showed an annual saving of approximately $8,000.00! And, a large part of this saving was obtained by eliminating weekend over-time work on pipe replacements.

Why not take the first step toward ridding your plant of corrosion *now?* Call in a Betz Engineer. Ask him to show you how Betz *Specialized* Water Conditioning Service can help you . . . quickly . . . economically . . . effectively. W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Pa. In Canada: Betz Laboratories Limited, Montreal 1.

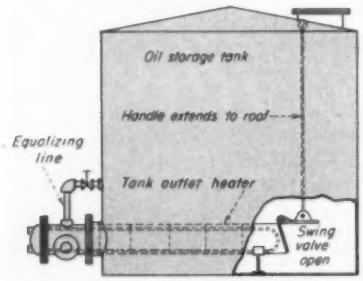
See for yourself how Betz filming amine treatment eliminates return line corrosion and reduces operating costs. Send for Technical Bulletin No. 124.

BETZ

CONSULTANTS ON ALL WATER PROBLEMS

ARGUMENTS

Here's the place to unload your gripes to editors, manufacturers and fellow engineers



Removing Tube Bundles

WHILE E H ROPER'S article, "Removing Coils from Full Oil Tank" (p 125, Nov POWER), explains a practical way of shutting off oil supply to a tank-outlet heater, the method is very expensive. Large-diameter gate valves are costly. In some cases cost of valve may exceed that of heater.

Simple-operating swing valve shuts off oil flow if tube bundle has to be removed. A machined surface on the heater shell and a flapper valve hinged at top-back end of shell do the work. Flapper has neoprene insert gasket that sets on the machined surface, oil pressure inside tank causes positive sealing. Handle extends to roof. Oil-equalizing line between storage tank and heater shell allows easy reopening of swing valve by equalizing pressures. Valves can be furnished as standard equipment.

H S LEWIS *Newark, N.J.*
Manning & Lewis Engineering Co

Is Dead Stop Possible?

MARMADUKE'S STORY about a Liberty ship's engine stopping dead (p 142, Nov POWER) is just a sea story. With his safety valves blowing to atmosphere, he must have had about 235 psi both in his drums and at his throttle. The wheel, having just left the water, must have been turning at 72 rpm or more. Momentum of wheel, bull gear, crank webs and all the other heavy parts, plus about 25 in. Hg in the condenser and 235 psi at the throttle, would certainly have kept the engine running.

If some tremendous force had brought it to a sudden dead stop, Marmaduke would have had to break out the oars and row to port, because he would not have had a propulsion plant left.

J J GEIST *Sheepshead Bay, N.Y.*

EDITOR'S NOTE: *But engine did stop, regardless—just as Marmy said.*

About 'Namby-Pamby Education'

I CAN EXPRESS an opinion on your editorial, "Namby-Pamby Education" (p 67, Nov POWER), for these reasons: (1) I came up both ways. In 1906, at 16, I was taken out of high school and put to work. Four years later I went back, finished both high school and college. (2) For a year I taught vocational classes in high school, and observed the attitude of one type of student.

I started working in the days of catch-em-young, treat-em-rough, tell-em-nothing. The old practical-experience men looked on college graduates as suspicious characters. Anything learned out of a book was no learning at all.

These men said: "Authorities require four years of high-school subjects to enter college. None of the subjects has any practical value, but they are required. So unless you are going to college, high school is wasted. It is better to go to work as soon as you finish grammar school."

But I know from experience that this reasoning is wrong. In any branch of engineering or science, high-school subjects are absolutely essential. Even if I had known I had to work for several years between high school and college I would have taken a college-preparatory course.

This is my idea of a good course:

(1) Mathematics: algebra, plane, solid and spherical geometry, and plane and spherical trigonometry. If possible, also coordinate geometry, elementary calculus or descriptive geometry.

(2) English: Four years, with as much oral and written composition, public speaking, and debating as possible.

(3) History: Four years, including ancient, medieval, modern, English, and U.S.; also U.S. and your own state constitutions, and your city charter.

(4) Science: physics, chemistry and physical geography, possibly biology.

(5) Latin: two years or more to give you a better understanding of English, and of scientific terms.

(6) Mechanical drawing: one year, with particular attention to care of instruments, lettering and ability to do neat pencil and ink work.

(7) Freehand drawing: one year to develop a sense of proportion.

I was taught that a boy's parents go to considerable effort to send him to school. So it is his duty to make the most of his opportunities. If he fails in this he should be taken out of school and put on his own.

Since adoption of compulsory education until 18, or work permits at 16, a type of student is kept in school to whom education beyond mere reading and writing has doubtful value. Numerous boys in high school say, "Just using up time until I am 16 and can get a work permit. What's the use of school anyway? I can make as much money heating rivets in a shipyard as a school teacher earns after five years of study in college."

Another type believes he can take it easy, have a good time, then make a last-semester spurt to finish at the top. Other students apparently do poorly at the beginning, but hard work and concentration finally show results.

Education should emphasize fundamentals. Teach a student what he is studying and why, show him it is to his interest to make the most of his opportunities. I have known men studying elementary arithmetic in night school to say, "How foolish I was not to learn this earlier. Why didn't my parents and teachers make it clear, instead of letting me grow up with wrong attitudes on education?"

H T LIVINGSTON *Los Angeles, Calif.*

Likes Proverbs

MAY I COMPLIMENT YOU on the leaflet entitled, "New Proverbs for Young Engineers"? These proverbs constitute information that all men wish to have, but they don't know where to find it. Let me commend you on the foresight and ingenuity you have shown in compiling this most interesting leaflet.

W C HARGRAVES *St Louis, Mo.*

EDITOR'S NOTE: *Proverbs referred to were written by Phil Swain and published in* POWER *some years ago. Many thousands have been distributed. If you would like a copy let us know. Leaflet is free while supply lasts.*

User Reports

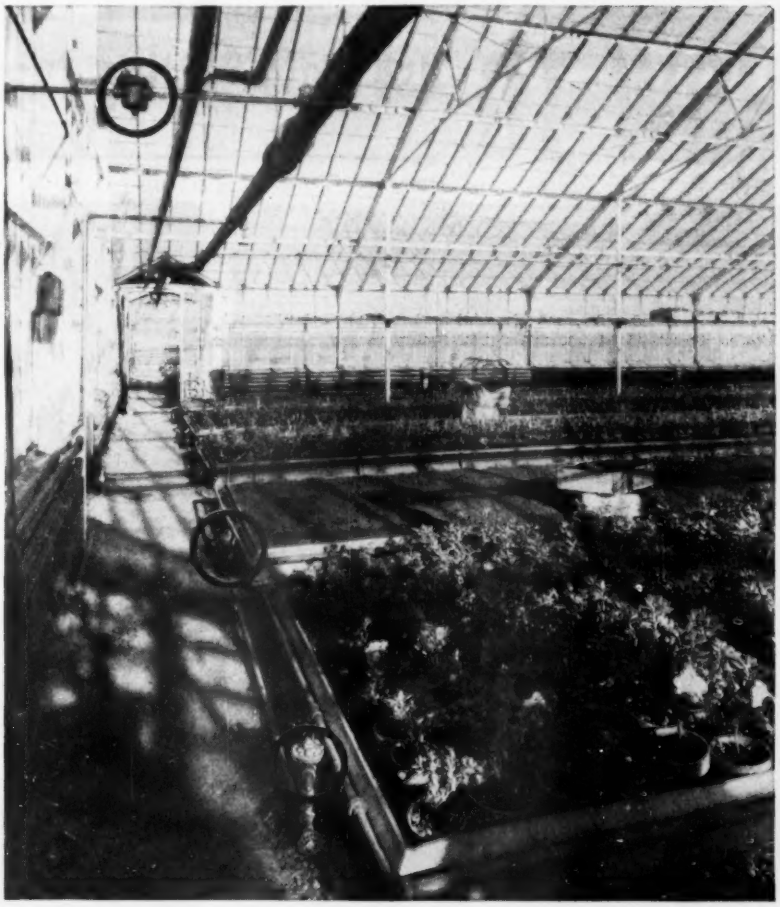
ARMSTRONG "UNIT TRAPPING"

cut his fuel bill

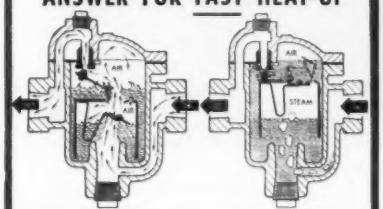
20%

and speeded heat-up

15%



"BLAST" TRAPS PROVE TO BE ANSWER FOR FAST HEAT-UP



THERMIC OPEN THERMIC CLOSED

Where steam is turned on and off periodically, blast traps give really fast heat-up, provided accumulated air and condensate is pocketed and will be pushed out ahead of incoming steam. A large auxiliary thermic vent in the bucket opens when the trap is cold, letting air whistle right through trap. When trap reaches 210°F the thermic vent closes and trap operates as a standard trap (see drawings above). Blast traps are ideal for single pipe coils, small on-and-off unit heaters, on-and-off multiple coils, drip points, etc. See page 39 of The Steam Trap Book.

Experience of Greenhouse Owner Points Way to Greater Efficiency in Any Plant . . .

THE problem of operating steam heated equipment efficiently is basically the same whether you operate a greenhouse, a refinery or a food processing plant. That is why the experience of Reiss' Greenhouses, Minneapolis, should prove of interest and value to you.

By replacing old, inefficient steam traps on heating piping with an individual Armstrong "blast" trap on each coil, Reiss' cut its fuel bill exactly 20% and speeded-up heating of cold coils by 15%.

This benefit was gained solely because Armstrong traps drain condensate and air from steam heated units as fast as it accumulates and without leaking steam. In Reiss' case the "blast" traps described at the left were particularly beneficial, and may be in your case. For complete information call your local Armstrong Representative, or write:

ARMSTRONG MACHINE WORKS
812 Maple Street, Three Rivers, Michigan

You Get More Out of Your Fuel When You Use Armstrong "Unit Trapping"

SEND FOR YOUR FREE COPY OF THE 44-PAGE ARMSTRONG STEAM TRAP BOOK!

Complete data on selection of traps for all types of equipment plus installation and maintenance recommendations, trap list prices and physical data.

JUST CLIP THIS TO YOUR COMPANY LETTERHEAD AND MAIL:

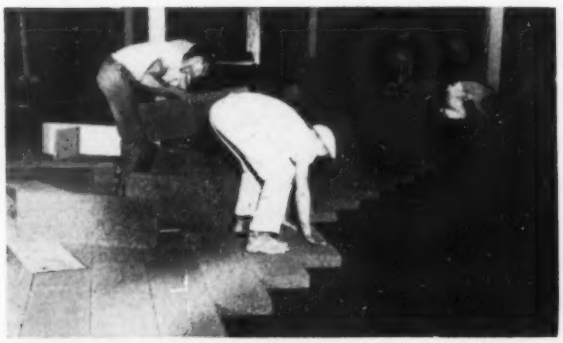
ARMSTRONG MACHINE WORKS
812 Maple Street, Three Rivers, Michigan

Please send me The Steam Trap Book.

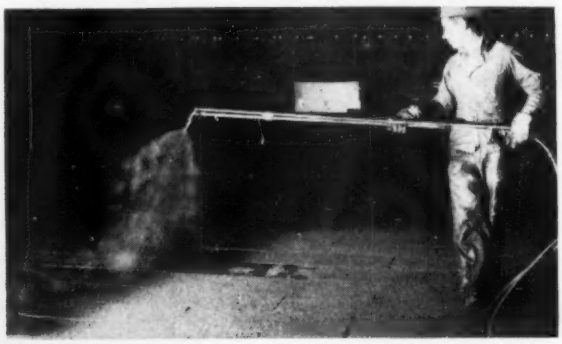
Name_____

Title_____

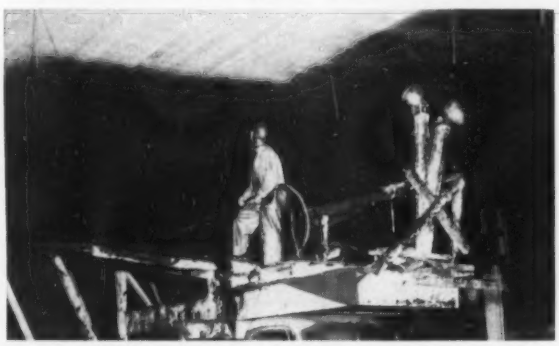
HOW TO Use Cold-Setting Insulation Products



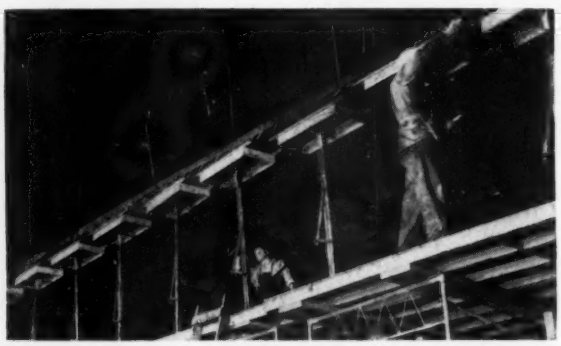
CORKBOARD for floor of cold-storage warehouse is placed on cured, insulation adhesive layer sprayed over 30-lb felt sheet



FIRST LAYER of corkboard is sprayed with cold-setting insulation adhesive. Tacky adhesive helps hold second layer in place



MOBILE SPRAY UNIT sprays ceilings with cold-setting insulation adhesive. The first layer of Fiberglas goes on next



QUICK-LEVERAGE temporary jacks press final Fiberglas-insulation layer into place. Both layers have coating of adhesive

VAPOR BARRIER of cold-setting insulation adhesive sprayed on 15-lb felt nailed to wooden walls. Results are excellent

GENERAL VIEW of a completed room. Fiberglas insulation is used on walls and ceilings. Guards protect walls, columns

COLD-SETTING INSULATION products for refrigerated spaces are plasticized-base asphalts. They are used for vapor barriers, insulation adhesives and protective coatings.

Advantages. Cold-setting products need no preheat. Setting is fast, applied with brush, spray, trowel. These self-sealing asphalts of special composition fill nail holes, crevices. Elimination of heating protects workmen from burns, plant from fires.

Adhesive. This is a heavy-bodied asphaltic emulsion compounded without fire-hazardous petroleum solvents or water-absorbent clays. It won't re-emulsify. After setting, adhesive is very tacky, even at low temperature.

Cement. Pressure-sensitive, rapid, waterproof set with high holding power on absorptive surfaces makes this cement ideal for cold-storage, etc. Free flowing for easy troweling, has no odor.

Coating. Factory-prepared materials set to tough, ductile, leathery coat.

Courtesy American Bitumuls & Asphalt Company, San Francisco, Calif.

ANNOUNCING
THE NEW
LUNKENHEIMER
VALVE
HANDWHEEL

"non-slip"* for positive closing

This revolutionary "Non-Slip" Handwheel introduces another Lunkenheimer improvement! Four rounded, non-slip lugs are gripped comfortably and firmly —operator's hand can't slip, even when wet or greasy. Result: Ordinary hand leverage closes the valve tight.

The new "Non-Slip" Handwheel is cooler, too—and keeps the operator's hand away from the top of the stem, which may be hot. It's sturdier, easier to operate, and makes your valves last longer.

*Patent Pending

WRITE FOR the name of your nearest Lunkenheimer distributor. He can show you samples of Lunkenheimer Valves with the new "Non-Slip" Handwheel. See them for yourself — *test them.* The Lunkenheimer Company, Box 360A, Cincinnati 14, Ohio.

BRONZE • IRON • STEEL

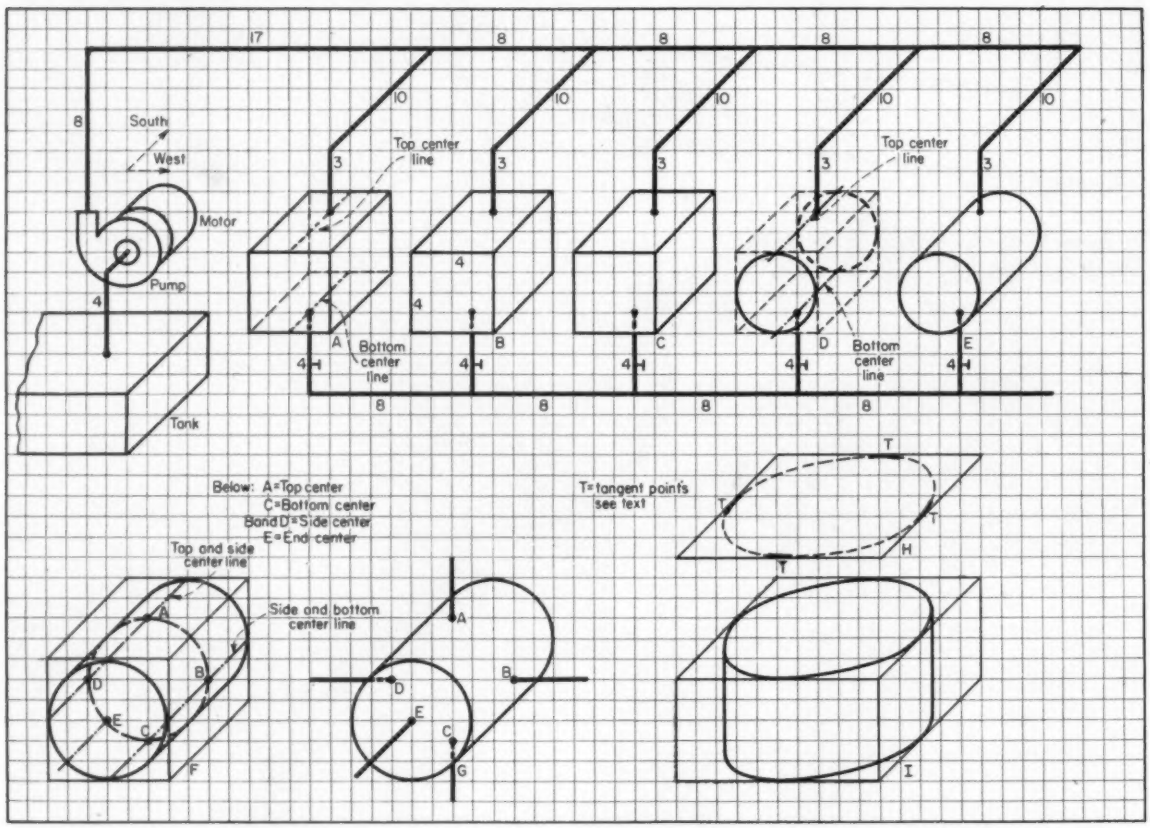
LUNKENHEIMER

THE ONE *Great* NAME IN VALVES

L-152-23

HEADWORK

PHIL SWAIN BRINGS ENGINEERING THEORY DOWN TO EARTH



Easy Sketching System—6

► NOW WE COME to hookups and tanks. Although most plant tanks are round, it saves work (and is often good enough for a rough hookup chart) to draw them square ended. Yet sketching a cylindrical tank is fairly easy if you draw it with the round end facing you. Then you can draw the end with a compass.

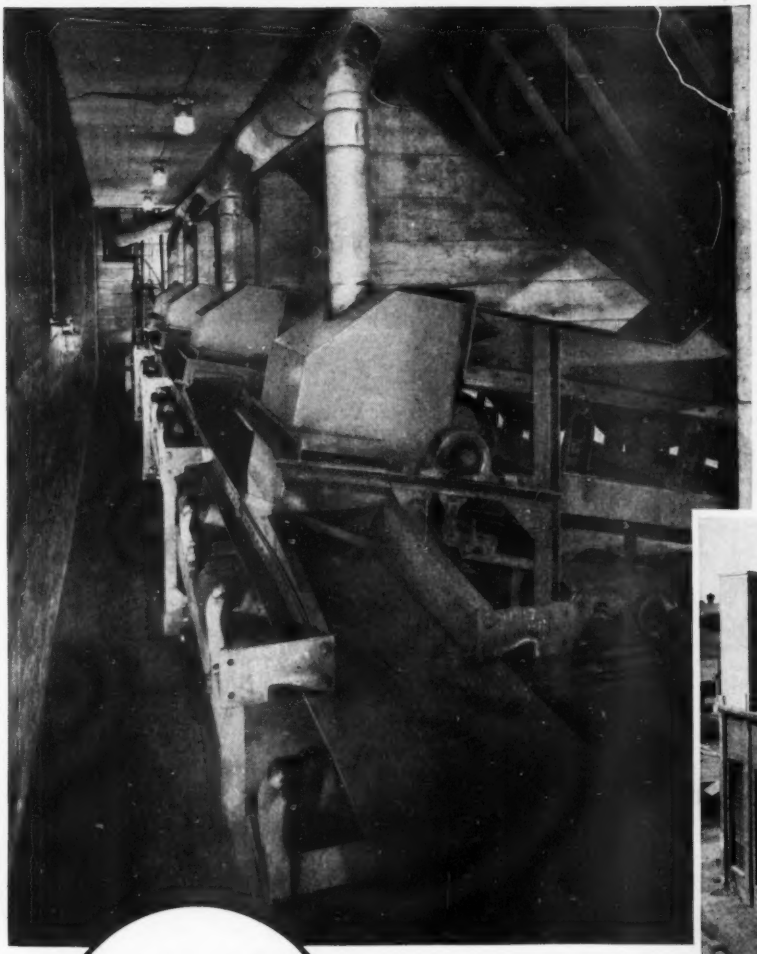
The tanks in the top hookup are pictured both ways. Note that the circular tank *E* is constructed by drawing a circular tank inside the square tank of *D*. In *D*, see how the center lines of top, bottom and sides are located and how the inlet and outlet pipes connect with the tank along these lines. The connection points in *E* are exactly the same as in *D*.

Tank *F* shows the same construction on a larger scale. Here the middle circle of the tank is also drawn. Its center lies on the diagonal line connecting the centers of the two end circles. Points *A*, *B*, *C* and *D* are centers of top, bottom and sides on tank *F* and also on tank *G*.

So far all circular parts have been drawn with a compass, but this is not possible with the open water tank shown at *I*. Here the top square is drawn in cabinet projection as a diamond. The top tank circle now appears as an ellipse, tangent to the center points of the four sides.

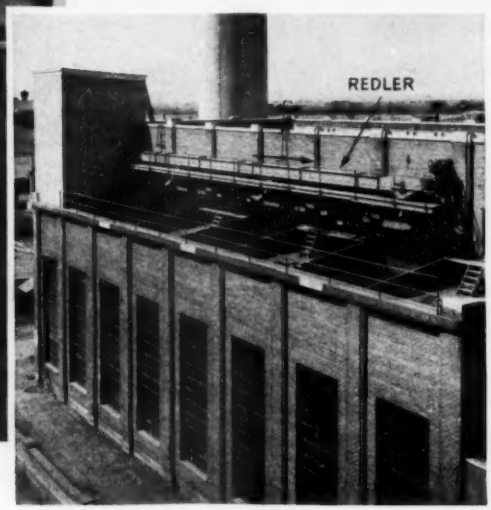
To do this well, first mark the four center points (sketch *H*) and draw the contacting parts of the ellipse. Then complete the ellipse freehand, or with a template. This gives the tank top.

Visible part of the tank bottom is merely a copy of lower half of ellipse.



THE AMALGAMATED SUGAR COMPANY
Nyssa, Oregon

Four 24-inch S-A belt feeders with variable speed drives carry coal from track hoppers to a main conveyor belt. This 24-inch belt carries the coal 240 feet to a REDLER L-type elevator. The REDLER elevator discharges on the seventh floor level to a horizontal REDLER that runs for 80 feet and feeds the stoker hoppers. Operating 6 hours out of 24, the complete system handles about 300 tons a day—46,616 tons in last year's operating season.



S-A CONVEYING *Systems* give coal a long ride

AT LOW COST with "free" transfers

Belt Conveyors
REDLER Conveyor-Elevators
ZIPPER Conveyor-Elevators
Weigh Larries
Crushers, Roll and Ring Type
Bucket Elevators
Pivoted Bucket Carriers
Screw Conveyors
Skip Hoists
Belt, Pan & Plate Feeders
Truck Hoppers & Bin Gates
TELLEVEL Bin Level Controls
Water Intake Screens
SEALMASTER Ball Bearing Units
Write for a bulletin on any of the above

Coal must move hundreds of feet and seven stories up to feed the stoker hoppers at this sugar plant. Several transfer points between conveyors are involved and the whole operation must be clean and dustless.

Whatever the coal handling problem—however simple or complex—the experience of S-A engineers, teamed up with the complete line of S-A equipment units, can find an economical and efficient solution. What's *your* problem? Write today—see if we don't come up with an answer profitable to you.

STEPHEN S-A DAMSON MFG. CO.

5 Ridgeway Avenue, Aurora, Illinois — Los Angeles, Calif., Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

"In amongst the coal? In a pig's neck!" sputtered the ship's Chief

Marmy's Blood Money

► EVERY NOW AND THEN we run across a POWER reader who has either sailed aboard ship or worked ashore with Marmaduke Surfaceblow. Result is always an unusual story, to say the least. Yesterday R B Smith of the New York Board of Transportation told us he sailed with Marmy years ago. We got busy and jotted down a few things that add up to the following story. You will notice, for a change, Marmaduke isn't telling this story on someone else. We really switched the cards on the old boy this time.

Back in 1914, the transatlantic liner SS *California* of the old Anchor Line signed on a fireman in Glasgow who soon became known as a character aboard ship. He was a big burly American, named Marmaduke Surfaceblow. Seems that Surfaceblow held an American unlimited chief engineer's license. But he missed his American ship in Glasgow and signed on the British ship as a fireman to work his way back to the States.

The *California* had twelve Scotch marine boilers of three fires each. One low fire in the center and two high wing fires. She burned coal and, like many ships of that period, she paid a bonus to the firemen for keeping steam up near the popping-off pressure. This point was marked by a red line, known aboard British ships as the "blood." And every fireman was out to earn as much "blood money" as possible.

A fireman's reputation depended on the amount of blood money he earned. That made competition keen and there was plenty of jealousy. Not only that, but firemen would work all the tricks of the trade to make it tough for their relief to earn a bonus. A favorite scheme was to leave dirty fires loaded with clinkers. That made it hard to keep up steam while cleaning fires. So there were plenty of hard feelings and fights.

Marmaduke was easily the biggest fireman aboard. He was 6 feet 4, and must have weighed 240 pounds in those days. But it was all beer and muscles. And the way he handled a slice bar and heaved in that coal was a pleasure to watch. His fires were all in top shape. And Marmy would make his rounds from boiler to boiler, helping each of his watch mates who needed help to keep their fires in top shape.

After the first few sea watches, it was easy to see that Marmy's watch would hit the jackpot for keeping the steam near the blood. His relief, a rowdy barrel-chested, Glasgow Irishman named Matt Feely, had been kingpin in the fireroom up until Marmy signed on. But Matt played dirty pool and gave his relief, a little London Englishman named Rod Wicks, a tough time.

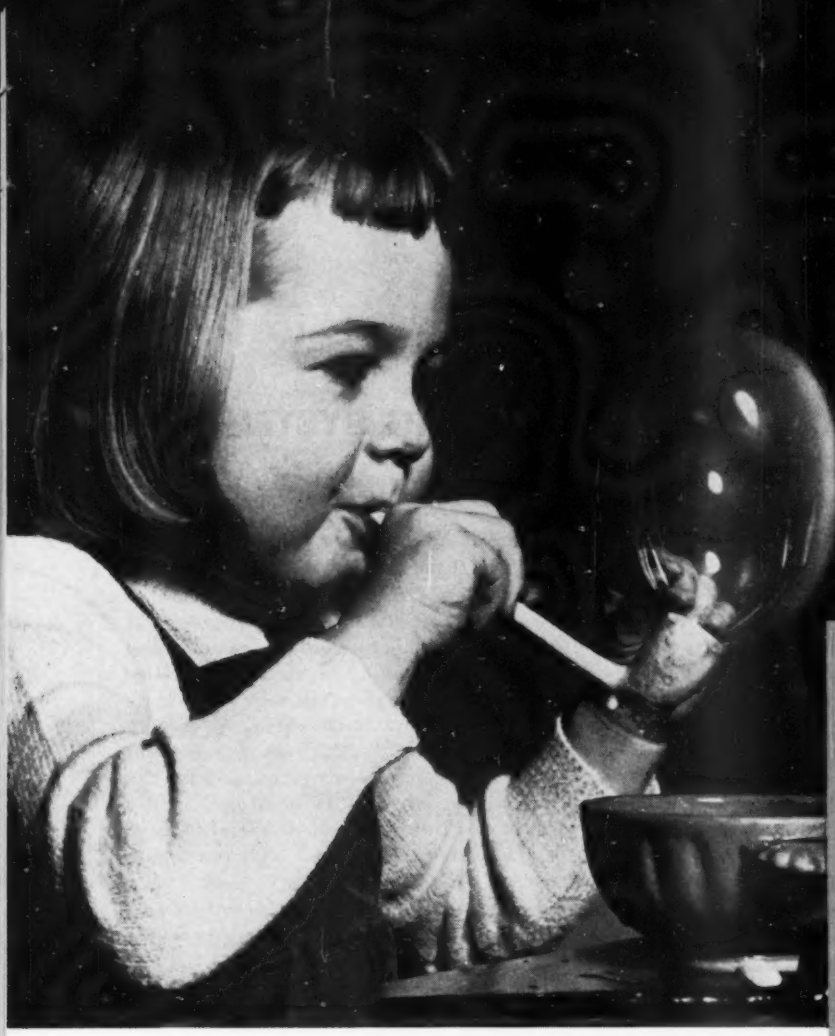
Marmy took sides with Wicks and started leaving dirty fires for Matt Feely. But Matt was only good at dishing it out and complained about Marmaduke to his watch engineer. Then one day Matt buttonholed the chief engineer up on deck.

Marmy got tired of Matt's complaints. One watch he made up his mind to really give Matt something to gripe about. Just before he was relieved at two bells, he hoed away the red coals in the middle of a high fire. Then he heaved in the heavy ship anvil. Next he covered up the anvil with burning coal.

Matt came on watch and started checking his fires as usual. When he came to that huge "clinker" in the middle of that high fire, he let out a roar. After trying to break it up with his slice bar, he called in the watch engineer. The engineer helped Matt wrestle with it, then sent the chief engineer an SOS.

The three of them finally worked that anvil out onto the floorplates. But the chief was poppin' mad and he sent a coal passer to get Marmaduke. The coal passer found Marmy in the fireman's foc'sle playing a red-hot game of poker and nursing a bottle of Sandpaper Gin. When Marmy was told that the Chief

(*Continued on page* 196)



SIMPLE and EASY TO USE

Midwest Reducing Elbow replaces two fittings: (1) a straight size elbow and (2) a reducer. One weld is eliminated with a resultant saving in layout time, welding, and cost. Pressure drop is reduced, appearance is improved and the piping is easier to insulate. Sizes to 12", reductions to half size.

Children get the hang of a bubble pipe almost by instinct . . . it's so simple and easy to use. Pipe welders report that they find Midwest Welding Fittings simple and easy to use because they are so uniform . . . so accurate to dimension . . . and because of their greater variety. Representative of this greater variety is the Midwest Reducing Elbow (shown at right) which takes the place of a standard elbow and a reducer . . . requires only two welds instead of three. For more information on why Midwest Welding Fittings are simple and easy to use, ask for Catalog 48.

MIDWEST PIPING & SUPPLY CO., INC.
Main Office: 1450 South Second Street, St. Louis 4, Mo.
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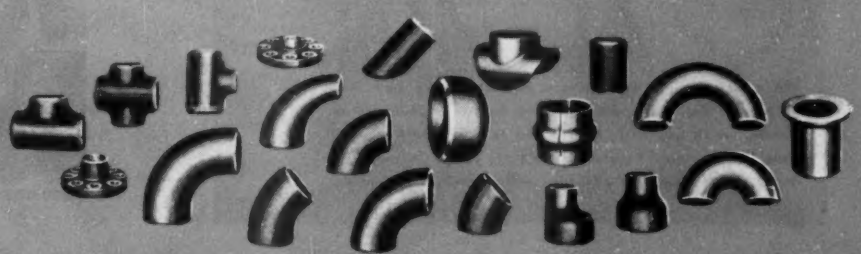
MIDWEST WELDING FITTINGS

MIDWEST
WELDING FITTINGS
Improve Piping Design and Reduce Costs



JENKINS PRACTICAL PIPING LAYOUTS

66

How to plan

PIPING CONNECTIONS FOR AN AIR-WASHER AIR CONDITIONING SYSTEM

The air-washer is one of the oldest methods of conditioning air for both industrial and non-industrial purposes. This device can be used to cool and dehumidify, or heat and humidify as well as clean air.

The system illustrated is a two-stage air washer designed to cool and dehumidify air for non-industrial (comfort) purposes. Although there are many possible piping arrangements and systems, the one shown is most generally used.

The piping is arranged to produce a counter-flow heat transfer between the spray water and the air. Basically, the system consists of a sheet metal housing in which nozzles spray water into an air stream, with water and air moving in the same direction. The effect of the spray water on the air stream is dependent on the temperature of the water and the wet and dry bulb conditions of the entering air stream.

Water from a chiller is sprayed through second stage nozzles for final cooling and dehumidifying of the air to the condition desired for use. This process raises the temperature of the spray water, which is collected at the bottom of the tank. Still at a temperature below the dew point of the entering air stream, this water is then pumped through the nozzles of the first stage. Here, too, the spray water cools and dehumidifies the air stream. This further raises the temperature of the spray water, which is then pumped back through the chiller where heat picked up in the two stages of the air washer is removed. The entire cycle is then repeated.

Excess moisture removal is effected between stages by a series of baffles which drastically changes the direction of the air stream many times before it enters the final stage. These violent directional changes cause any droplets of water suspended in the air stream to drop out. The baffles are kept constantly wet by separate water spray, and collect dust and dirt from the air stream. Thus, air is cleaned sufficiently for most normal purposes. Final air conditions are automatically controlled by proportionate mixing of chilled and return water by means of a three way valve.

Jenkins Fig. 651-A Iron Body Bronze Mounted Gate Valves are recommended for various shut-off and other points in this system. The solid wedge and semi-steel body and bonnet provide maximum resistance to pressure strains. The through-port design of the body permits free flow without constriction. Operating threads are on the outside, allowing easy cleaning and lubrication. The rising spindle serves to indicate the position of the wedge, which is solid bronze in the smaller sizes, and cast iron with rolled-in bronze rings in the larger. The valve is equipped with renewable bronze seat rings.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation.

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from the complete Jenkins line. It's your best assurance of *lowest cost in the long run.* Jenkins Bros., 100 Park Ave., New York 17. Sold through leading Industrial Distributors everywhere.

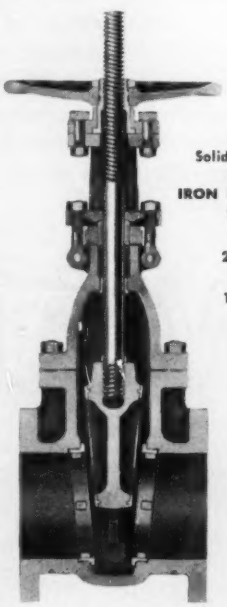


Fig. 651-A
Solid Wedge — O.S.&Y.
Rising Spindle
IRON BODY GATE VALVE
125 lbs. Steam
2" to 12"
200 lbs. O.W.G.
14" to 24"
150 lbs. O.W.G.

The *extra* measure of efficiency and endurance built into *all* Jenkins Valves is a distinguishing feature of Jenkins Iron Valves, which are made in a broad range of patterns and sizes. Yet you pay no more for this extra value. Compare the quality, and see why it pays to specify *Jenkins* Iron Valves.

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Illustrating the proved 3-point formula for trouble-free, time-defying hookups

A **Use the right type valve for the service**

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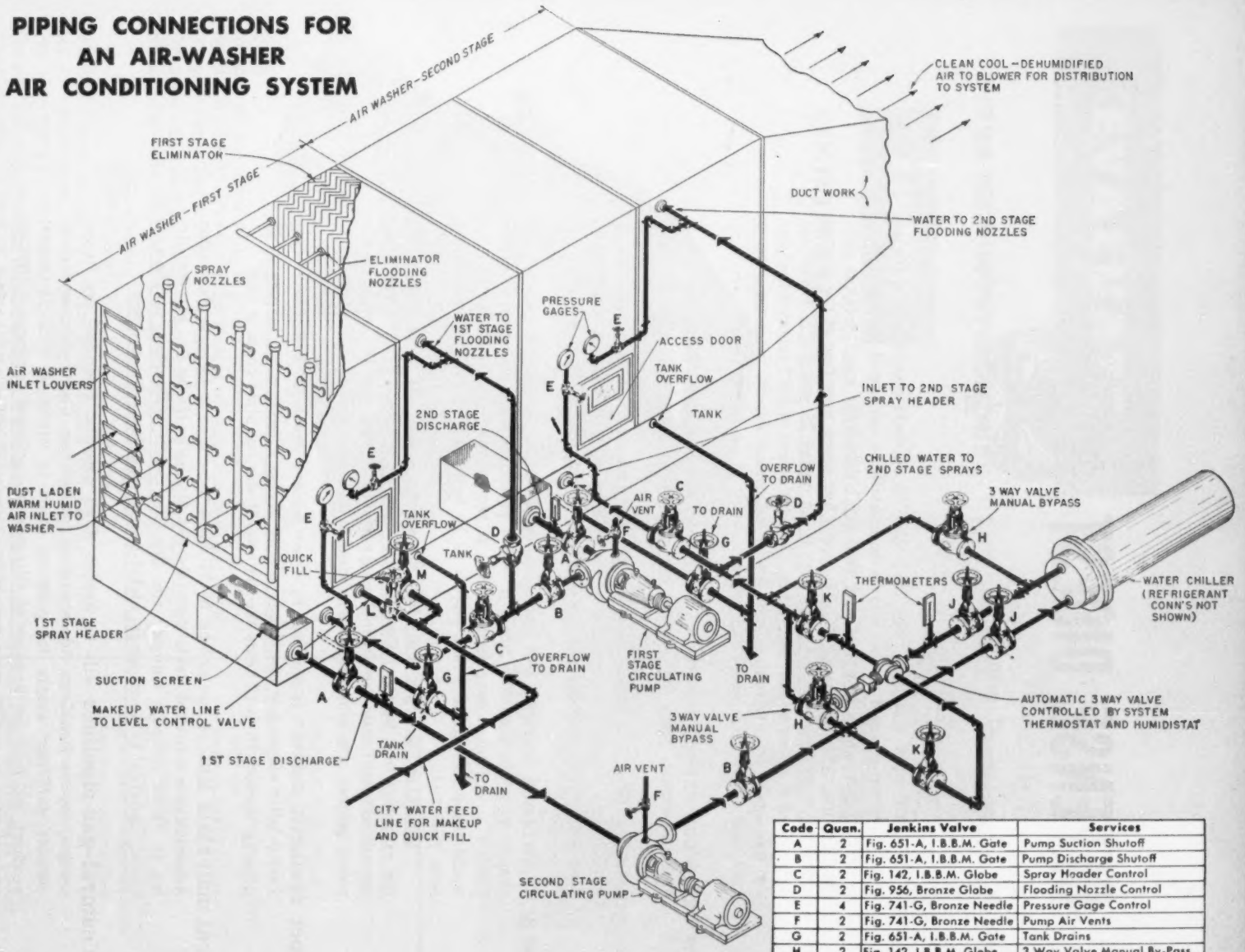
C **Choose Jenkins for lifetime economy**

JENKINS VALVES

LOOK FOR THE DIAMOND MARK

SINCE 1864 TRADE JENKINS MARK



Code	Quan.	Jenkins Valve	Services
A	2	Fig. 651-A, I.B.B.M. Gate	Pump Suction Shutoff
B	2	Fig. 651-A, I.B.B.M. Gate	Pump Discharge Shutoff
C	2	Fig. 142, I.B.B.M. Globe	Spray Header Control
D	2	Fig. 956, Bronze Globe	Flooding Nozzle Control
E	4	Fig. 741-G, Bronze Needle	Pressure Gage Control
F	2	Fig. 741-G, Bronze Needle	Pump Air Vents
G	2	Fig. 651-A, I.B.B.M. Gate	Tank Drains
H	2	Fig. 142, I.B.B.M. Globe	3 Way Valve Manual By-Pass
J	2	Fig. 651-A, I.B.B.M. Gate	Water Chiller Shutoff
K	2	Fig. 651-A, I.B.B.M. Gate	3 Way Valve Shutoff
L	2	Fig. 47 Bronze Gate	Feed to Level Control
M	1	Fig. 651-A, I.B.B.M. Gate	Tank Fill Valve for Start up

VALVE RECOMMENDATIONS
For details of valves to suit varying conditions, see Jenkins Catalog

Diagram by Huxley Madeheim, Consulting Engineer
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Jenkins Bros

DEFENSE DIGEST

Your roundup of mobilization news and trends affecting power men

1952 power figures show that U.S., with less than 7% of world population, produced 45% of estimated world power. Russia and satellites accounted for about 16%.

Last year's U.S. output of more than 400 billion kwhr was two-thirds more than the first "peace" year (1946), two and a half times more than at the start of World War II (1941), and more than five times output 25 years ago. Reflecting differences in reserves and load factor, capacity at end of 1952 (about 84 million kw) was again about two-thirds more than 1946, almost exactly twice capacity in 1941, and almost three and a half times capacity 25 years ago.

Copper users can expect more metal in 1953 than any year since World War II, but problems remain. Many feel price is too low to stimulate new output.

Arms-spending rise will continue through 1953 but nature of spending will change. More dollars will go for items coming off production lines, less for plant expansion and inventory buildup. So net effect on the economy will be less.

Latest St. Lawrence Seaway bill (sponsored by Sen Wiley, R) looks to have a good chance to reach Congress floor. It would permit Federal government to join Canada in building a deep-draft channel in the International Falls section, but would leave associated power project to be built by Province of Ontario and New York State.

Divorcing the power angle from the seaway proper may make Wiley's bill the exception in a long list Congress has ignored or turned down. Canada has announced it will build the channel single-handed if legal path is cleared for the power project, which includes a dam vital to the waterway.

Cheaper synthetic rubber is promised by a new process developed by B F Goodrich. Still in pilot stage, new continuous method blends butadiene and styrene in 15 minutes, against 10 to 12 hours the old way. It may cut plant costs in half.

Critical materials list is now shorter by 13 items, according to Defense Production Administration's List of Basic Materials and Alternates (Issue No. 10). Remaining in "most critical" category are: titanium, cobalt, columbium, molybdenum, nickel, tantalum, heavy castings, nickel-bearing stainless, diamond bort.

More natural-gas pipelines will be needed if all potential customers are to get service, reports Petroleum Administration for Defense. Utility-company figures indicate sufficient supply for peak-day loads in winter of 1952-53 (normal weather). But peak-day demands of all potential customers in winter of 1955–56 are expected to be 50% more than 1951-52 peak (38 billion cu ft against 23.5 billion).

Aluminum output losses caused by hydro-power shortages in Pacific Northwest and the Tennessee Valley are expected to run about 120 million lb in first quarter of 1953. Losses are being met by thinning the industry's "pipelines" and reducing allotments to the national stockpile. These adjustments and improvement in water conditions should bring 1953 situation back into line.

EVALUATE

THE NEW WESTINGHOUSE

AIRFOIL

CENTRIFUGAL FAN

Recently the Sturtevant Division of Westinghouse introduced another major advance in fan design—the new Airfoil-Bladed Centrifugal Fan. Now, just off the press, is a new catalog describing it in full detail.

Sturtevant's scientific application of Airfoil Blading has produced a new high in efficiency and a new low in noise level. Result:

Peak Efficiency .....90% *plus*
Noise Intensity .....65% *less*

Wherever a lower operating cost means more than first cost—where evaluation and a reasonable price mean more than a low price—the Westinghouse Airfoil, Non-Overloading Fan is the answer.

Get your free copy of Catalog 1320 today. Contact your nearest Westinghouse-Sturtevant office, or write to Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Mass.

Airfoil Fans Installed or to be Installed at:

Consolidated Edison—Astoria
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Tennessee Valley Authority—Kingston-Colbert
Hartford Electric Company—Laurel
Southern California Edison—Redondo
Tucson Gas & Electric Company—Station #3
Gulf States Utilities—Nelson
Squirrel Hill Vehicular Tunnel—Pittsburgh
Kaiser Manufacturing Co.—Detroit

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STURTEVANT DIVISION

J-80268

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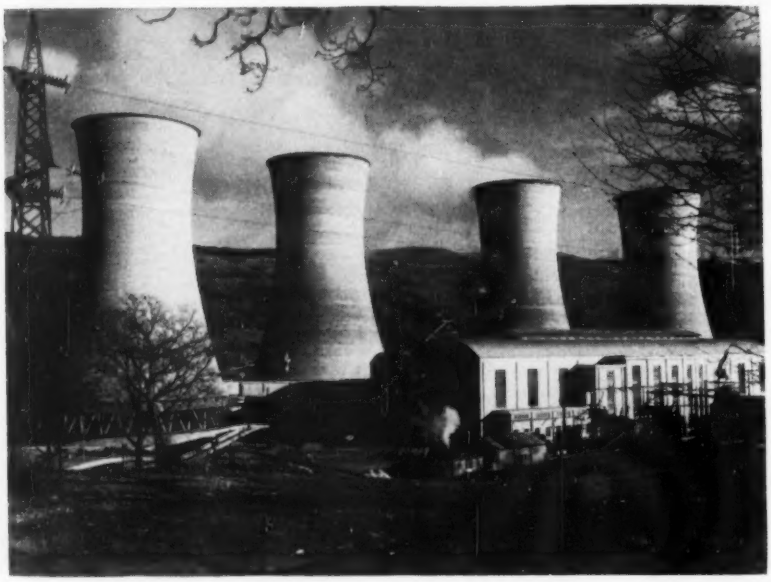


Italy's Lardarello Geysers Take On More Load

Recently opened Lardarello, Italy, Power Station No. 3 is one more of the important geothermal steam stations making use of the natural steam vents or geysers in this region. This one adds still another 120,000 kw of turbine's generator capacity on the line in four 30,000 kw units, plus two 15,000 kw auxiliary and standby turbines. An estimated 900,000,000 kwhr will go out on the transmission line to swell the yearly total to 2½ billion kwh in this region.

Coming Events

March 24-27—Second Annual American Power Conference, Sherman Hotel, Chicago, Ill. R A Budenholzer, Chairman, Illinois Institute of Technology, 3300 Federal St, Chicago 16, Ill.

March 24-27—National Power Show and annual meeting National Assn of Power Engineers held in conjunction with American Power Conference, Sherman Hotel, Chicago, Ill. A F Thompson, sec, 176 W Adams St, Chicago, Ill.

April 10-11 — Michigan Engineering Society, Kellogg Center Hotel, Michigan State Campus, East Lansing, Mich. J E Wilbur, sec, P O Box 573, Kalamazoo, Mich.

April 13-15—American Society of Lubrication Engineers, annual meeting, Hotel Statler, Boston, Mass. W P Youngclaus, Jr, ASLE, 343 S Dearborn St, Chicago 4, Ill.

April 17-18—New Jersey Society of Professional Engrs, 29th annual convention and exhibition, Hotel Essex House, Newark, N. J. C J Dodge, exec director, NJSPE, 86 E State St, Trenton, N. J.

April 22-24—American Institute of Electrical Engineers, Southern district, Seelbach Hotel, Louisville, Ky. H H Henline, secy, AIEE, 33 W 39th St., New York 18, N. Y.

April 28-30—American Society of Mechanical Engrs, spring meeting, Drescher-Warrick Hotel, Columbus, Ohio. O B Schier, mgr, ASME, 29 W 39th St, New York 18, N. Y.

Nation's Power Capacity Holds Edge

The president of the Edison Electric Institute, Atlantic City Electric Co's Bayard L England, in the recent EEI year-end Review, painted a most encouraging picture of the major power industry developments in 1952.

Perhaps the most significant was the organization of the Ohio Valley Electric Corporation by 15 power companies of that region to build two steam plants with a combined capacity of 2.2 million kilowatts for the Federal Government's Atomic Energy Commission. This organization follows the pattern established two years earlier by the five-company Electric Energy Inc, which is installing 900,000 kilowatts in southern Illinois near Paducah, Kentucky, also to supply power to the Federal Government.

A similar pattern of cooperative action in a major undertaking is the proposal of five New York State power companies to carry out, if Congress grants permission, the redevelopment of Niagara Falls.

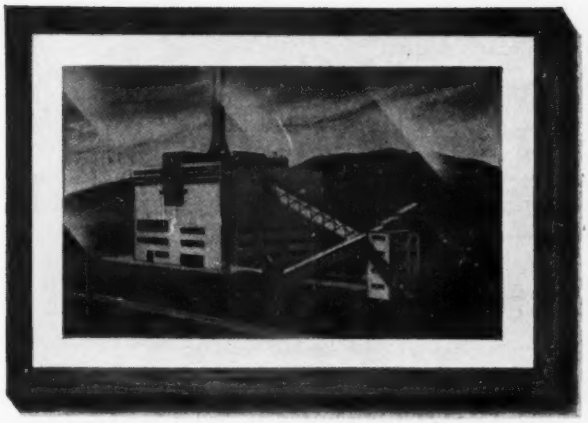
These examples, England feels, nullify the claim often made that private capital is unable or unwilling to undertake large-scale power developments and that the Federal Government must, therefore, build such projects.

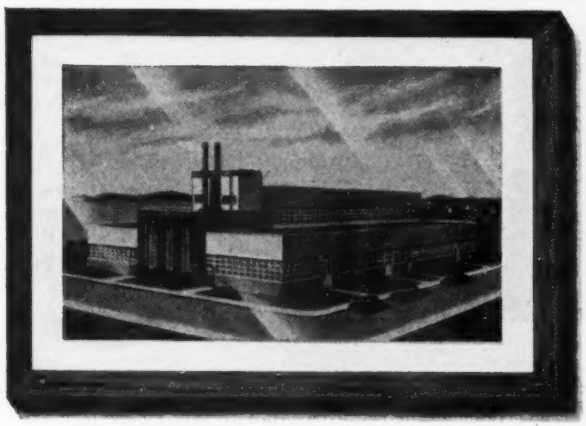
Another development of long-range importance to the power industry is the study of the technical and economic problems of converting atomic energy into electric power by five groups of companies under agreement with the Atomic Energy Commission. Among the companies entering into these agreements are the Union Electric Company of Missouri, The Detroit Edison Company, the Commonwealth Edison Company and Public Service Company of Northern Illinois, the Pacific Gas and Electric Company, and the Pioneer Service and Engineering Company of Chicago. By arrangement, engineers from several other power companies are participating in the studies under these agreements.

The withholding by Congress of appropriations for many unnecessary duplicating transmission lines and other power facilities proposed by government bureaus was another significant industry development of 1952.

England emphasized that an adequate supply of power was available in all sections of the United States throughout the year 1952, with two exceptions. In the Pacific Northwest drought was ex-

(*Continued on page* 224)





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B&O coals are excellent for generating steam in utility and industrial power plants, for steel mills, malleable iron plants, gas plants, lime and brick kilns, cement and glass plants, and potteries.

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TECHNICAL BRIEFS

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HYDRO POWER
PUMPS
GAS TURBINES

HIGHEST HEAD AND LARGEST HYDRAULIC TURBINES BUILT IN EUROPE

Highest-head pelton turbines

Plant name	Location	Head, ft	Output, hp	Speed, rpm	Manufacturer
Reisseck	Austria	5800	31,000	750	Charmilles
Dixence	Switz.	5700	50,000	500	Charmilles
Mieville	Switz.	4750	47,800	500	Charmilles
Portillon	France	4280	55,600	500	Charmilles with Alsthom-Charmilles
Pragnieres	France	3920	100,000	428	Neyrpic
Pianto Netto	Italy	3920	14,700	600	Riva
La Bathie	France	3820	96,400	428	Neyrpic

Highest-head francis turbines

Fionnay*	Switz.	1490	63,200	750	Escher Wyss
Limberg	Austria	1430	77,700	500	Escher Wyss
Vinstra	Norway	1360	69,000	500	Kvaerner Brug
Fiastrome	Italy	1320	20,140	1,000	Escher Wyss
Hol	Norway	1265	60,000	500	Kvaerner Brug
Kaprun*	Austria	1245	71,000		Escher Wyss
Bitto	Italy	1225	14,625	1,260	Escher Wyss
Roduno	Austria	1130	66,200	500	Escher Wyss

Highest-head kaplan turbines

Plant Name	Location	Head, ft	Output, hp	Speed, rpm	Manufacturer
Bort-Rhue*	France	230	31,800	375	Neyrpic
Barcis	Italy	199	13,600	500	Escher Wyss
Requejada	Spain	188	5,730	500	Escher Wyss
Rocchetta	Italy	184	5,000	500	Charmilles
Invergarry*	Scotland	177	28,000	250	English Electric
Pollaphuca	Ireland	165	25,000	300	Charmilles, with English Electric
Ligga*	Sweden	130	105,650	127	Karlstad

High-powered hydraulic turbines

Bort Les Orgues	France	336	154,000 F	187.5	Charmilles, Alsthom-Charmilles, Neyrpic
Chastang	France	233	135,000 F	150	Charmilles, Alsthom
Harspranget	Sweden	344	133,350 F	167	Karlstad
Sungari	Manchuria	226	115,500 F	125	Escher Wyss
Kilforsen	Sweden	312	112,730 F	167	Karlstad
Ligga*	Sweden	130	105,650 K	125	Karlstad
Pragnieres	France	3920	100,000 P	428	Neyrpic

* Under construction; F, francis; K, kaplan; P, pelton

Hydro Power

Modern Trends in Hydraulic Turbine Design in Europe. *By George A Bovet, Charmilles Engineering Works, Geneva, Switzerland.*

Modern trends in hydraulic-turbine design in Europe are described, especially how they differ from American practice. Even though there has been no major inventions in hydraulic turbines during the last 20 years, many outstanding units have been built in Europe for exceptionally high heads and of large sizes, as shown in the tables above. These tables are picked from extensive ones given in the paper.

The highest head pelton turbines will be in the Reisseck plant in Austria, rated 31,000 hp under a 5800-ft head. This is more than double the highest head used in the U.S. For francis type the 63,200-hp units in Fionnay plant in Switzerland will have the highest head, 1490 ft. The 230-ft head of the 31,800 Bort-Rhue kaplan units in France is more than double the highest head used on turbines of this type in this country. The Bort les Orgues in France has the largest francis turbines in Europe, 154,000 hp. Design capacity of these units is about the same as for the Grand Coulee units in this country, but the latter operates continuously loaded to 170,000 hp. *ASME paper No. 52-A-92.*

Pumps

Mechanical Pumps for High-Temperature Liquid Metals. *By Philip M Clark, Knolls Atomic Power Laboratory, General Electric Co.*

As a part of the development of nuclear power for submarine propulsion the General Electric Co designed and built a relatively large heat-transfer test system in which liquid sodium and liquid sodium-potassium were used as heat transfer media.

For this system it was necessary to develop a pump that could circulate about 400 gpm of liquid metal at temperatures up to 750 F, without leakage at the shaft. But, a small gas leakage could exist. Two identical centrifugal pumps were built and have operated successfully for several thousand hours. A description of the pump design, associated seal development and operating experience are represented in this paper.

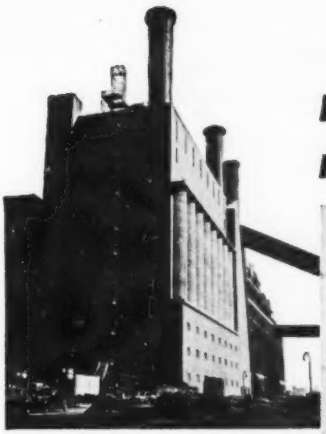
Detailed designs of the two pumps were developed in cooperation with the Buffalo Pump Co, where the two pumps were built. Each pump is a single volute, radial centrifugal design with a 926 specific speed and rated 400 gpm, 126 ft head at 1750 rpm. The pumping elements are contained in a large drain tank filled with inert gas under pressure, while the supporting bearing and 20-hp, motor are above the floor plate.

Sealing the pump against leakage was one of the difficult problems that had to be solved. Different types of packing were tried, but without complete success, when the development was switched to rotary seals. To keep the leakage down to less than 0.1 cu ft per hr both carbon and wear rings were lapped to less than three light bands and in most cases to less than one. Minute quantities of lubricant increased seal life to more than 2000 hr. *ASME paper No. 52-A-94.*

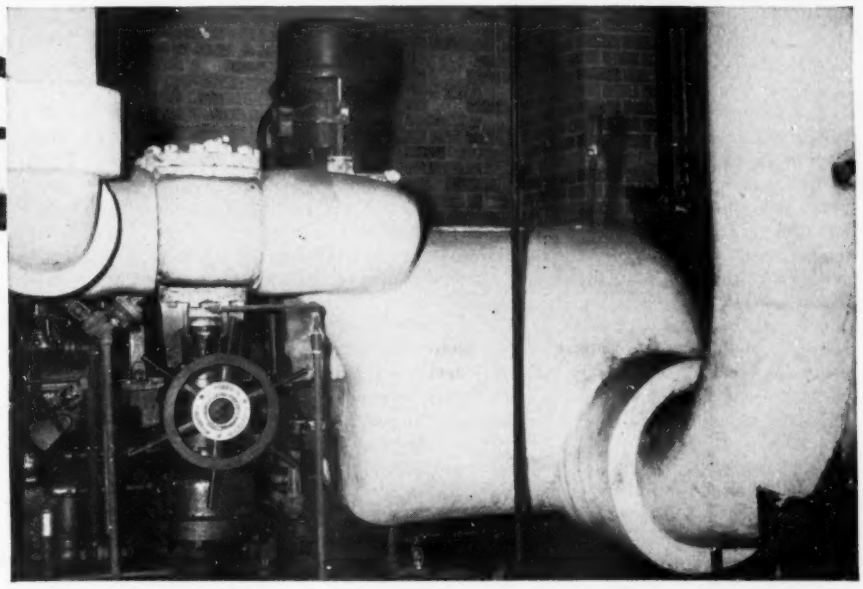
Development of Special Pumps, Their Power Supply, Valves, Bearings, and Instrumentation for Liquid Metals. *By Edward F Brill, Allis-Chalmers Mfg Co.*

When planning and designing nuclear power plants the pumps or blowers for circulating coolants through the reactors to transfer heat to a power cycle or heat sink require special attention. They must circulate the coolant without failure, leakage or require maintenance for long periods. The paper discusses the several types of these pumps that have been developed and the uses for leakless pumps for high pressures and temperatures.

Among the pumps are the hermetically sealed designs of which three types have been built. They are the canned



For this new addition to their New York City power plant at East River and 14th Street...



(Above) View of recently completed annex to Consolidated Edison's power plant... another link in their gigantic expansion program. **(Right)** Close-up of J-M 85% Magnesia Insulation on boiler feed lines. It was expertly installed by the Asbestos Construction Company, Inc., an outstanding J-M Insulation Contractor.

CON EDISON SPECIFIES J-M 85% MAGNESIA PIPE INSULATION FOR MAXIMUM FUEL SAVINGS

Like all materials that went into the new power plant addition of New York's leading gas and electric supplier... the pipe insulation had to be the *best*. That's why Consolidated Edison Co. specified J-M 85% Magnesia... industry's No. 1 insulation for many decades and *still* the leader in its class.

J-M 85% Magnesia is the leading insulation on the market for temperatures up to 600F. It is bonded with asbestos fibers. This rugged insulation will not distort regardless of the length of time it stays in service. J-M 85% Magnesia fits snug and stays put. Heat savings, therefore, remain constant for the life of the equipment on which this insulation is applied.

For temperatures over 600F, J-M 85% Magnesia is used in combination with Superex*, a J-M insulation for service to 1900F. This double-layer construction, known as Superex Combination, eliminates through joints and protects the jacket against scorching. It also utilizes the higher heat resistance of Superex next to the hot surface, and the greater insulating value of J-M 85% Magnesia for the outer layer.

*Reg. U.S. Pat. Off.

Experience has proved that all insulations must be properly installed to pay maximum dividends. That's why Johns-Manville offers industry the services of experienced insulation engineers and installation contractors who have made a career of solving complex insulation problems. From coast to coast, these engineers and the contractor's highly skilled mechanics stand ready to combine their talents and give you an insulation job that will more than pay off your initial investment with maximum fuel savings through the years.

When you face your next insulating problem... remember that Johns-Manville is "Insulation Headquarters." Consult your near-by J-M Insulation Contractor... or write direct to Johns-Manville, Box 60, New York 16, New York. In Canada, write 199 Bay Street, Toronto 1, Ontario.

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Johns-Manville *FIRST IN* INSULATION

MATERIALS ENGINEERING • APPLICATION

More TECHNICAL BRIEFS

Begins on page 154

induction motor; unipolar motor; and turbomagnetic drive. The latter may be considered to be a canned eddy-current clutch driven by a turbine or motor. All three have been built in sizes from ½ to several hundred horsepower, each for a specific application.

The canned induction-motor drive is suited to high system pressures and has been designed to handle fluids at 1000 F in the rotor space with the pump impeller operating at about 1500 F. Turbomagnetic drive pumps are suited for temperatures up to 1500 F, but at low system pressures. Unipolar motor drives can be applied to pumping liquid metals and has the advantage of being a low-voltage unit that requires little electrical insulation. It can be built to operate efficiently with heavier walled cans than the turbomagnetic or canned induction motor.

Bearings, valves, liquid-level indicators' liquid-level controllers, flowmeters and pressure measurements are also considered. A fluid-piston type bearing in which the journal is kept centered in the bearing shell by liquid under pressure is described in detail. *ASME paper, no number, available only from the author.*

Electromagnetic Pumps for High-Temperature Liquid Metals *By J F Cage, Jr, Knolls Atomic Power Laboratory, General Electric Co.*

Liquid metals are used to cool atomic energy reactors. To circulate these coolants special types of pumps, described in this paper are used. For this service electromagnetic pumps are well suited, all of which use the electric-motor principle—a conductor carrying a current in a magnetic field has a force exerted on it.

The author shows the elements of one of these pumps, known as the Faraday type. Liquid metal contained in a thin-walled rectangular duct has a magnetic field passed through it. An electric current passes through the liquid at right angles to the magnetic field. Usually the low-voltage power-source conductors are brazed directly to the duct. Reaction of the magnetic field of the current on the field from the pole pieces produces a force on the liquid causing it to flow. Pumps of this type have been built for 400 gpm at heads up to 100 ft. A unit that delivers 135 gpm against a 21 ft head weighs 950 lb and requires 6000 amp at 1.25 volts.

Other designs of electromagnetic pumps use the induction-motor principle and operate on 60-cycle ac. One of these units delivers 1200 gpm of 850 F sodium at 110-ft head when using 288 amp at 300 v. This unit weighs 6430 lb and requires 2000 cfm of cooling air. *ASME paper No. 52-A-66.*

Measurement of Pulsating Flow with Propeller and Turbine Type Meters. *By R B Dowdell and A H Liddle, Jr, Builders Providence, Inc.*

It has been conclusively proven, both by theory and experiment, that it is impossible to accurately measure pulsating flow with a differential type flow meter when pulsations are excessive. The suppression of pulsations in a pipe line, either by filters or surge tanks, is often unsatisfactory and may prove to be a large expense; thus, a meter which will accurately measure pulsating flow has long been desired. The data presented in this paper show that with the magnitude and frequency of pulsations tested, a propeller type flow meter will accurately totalize the flow of an incompressible fluid. The Shuntflow Meter, a device which combines some of the features of a differential type meter and some of those of a propeller type meter, though performing accurately under some conditions, may produce readings with considerable error when measuring a compressible pulsating flow.

Two different testing set-ups, one utilizing water as the working medium and the other using steam, were used. All hydraulic tests were made at the Hydraulics Laboratory of Builders-Providence, Inc, Providence, R. I. The flow from a fixed head tank passed through a control gate valve before entering the straight run of pipe preceding the meter. This valve was wide open at all times during testing; thus, all results are for a meter operating under a constant total head. The six-inch test meters were preceded by a straight run of 52 inches of six-inch pipe which, in turn, was preceded by a straight run of 53 inches of 8-inch pipe. These two sections of pipe were joined by an 11-inch long, 8-inch by 6-inch reducer. The 8-inch meter was preceded by a straight run of 94 inches of 8-inch pipe. Two sets of straightening vanes were installed in the upstream end of the 8-inch pipe to eliminate the possibility of a swirl following the elbow. The 6-inch meters were followed by a 32-inch length of straight 6-inch pipe, while 12 inches of 8-inch straight pipe and 20 inches of 6-inch pipe followed the 8-inch meter. In both cases, this entered directly into the pulsation producing loop. This loop consisted of (1) a straight-through section of 6-inch pipe which contained a continuously rotating 6-inch butterfly valve followed by a control gate valve, and (2) a by-pass line containing a six-inch gate valve. Pulsations were produced at a constant frequency by driving this rotating valve at a constant speed. *ASME Paper No. 52-A-32.*

TO OBTAIN COMPLETE TEXT

Material for these abstracts comes from the one source. Order complete paper from source, not POWER.

American Society of Mechanical Engineers, annual meeting, Statler Hotel, New York, N. Y. Nov 30-Dec 5, 1952. Identified by initials ASME and obtainable through ASME, 29 W 39th St, New York 18, N. Y.

Gas Turbines

Installation Factors Related to Gas Turbines in Closed Compartments. *By L W Shallenberg, J O White, K E Schlachter, USN Engineering Experiment Sta.*

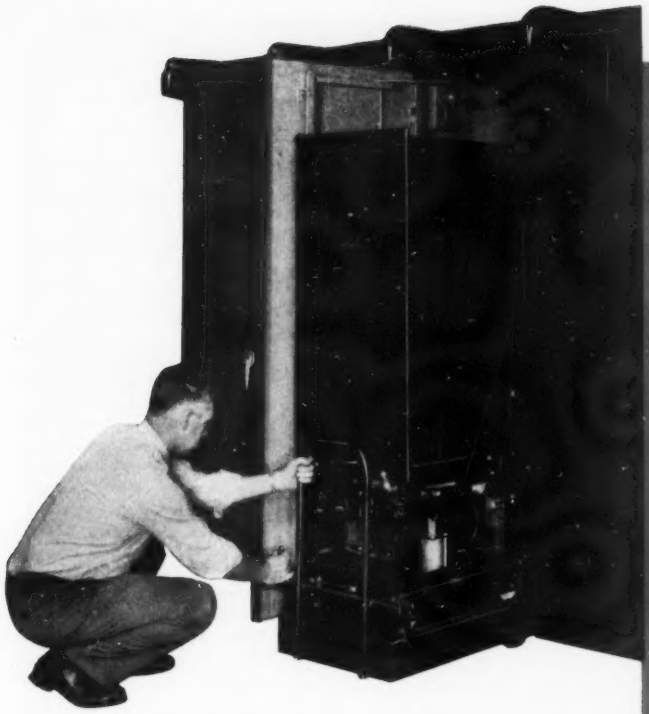
The U.S. Navy is presently constructing a group of wood-hulled vessels. To meet size and weight limitations, gas turbine engines are being installed for generator drive.

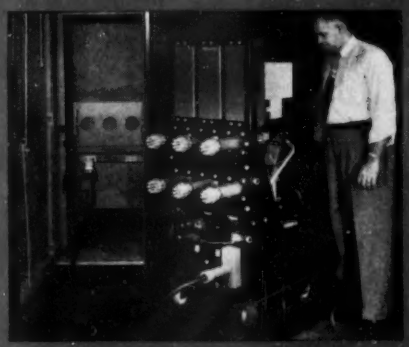
Problems of design which arose in connection with the installation of gas turbine engines in a closed compartment are discussed and the solutions as developed at the U.S. Naval Engineering Experiment Station are given.

The problems discussed are: (a) The maintaining of satisfactory temperature limits in the compartment. (b) The maintaining of satisfactory temperature limits on the exhaust ducting and stack. (c) A combustion air inlet system that will prevent sea-water droplets entering the compressor, partially silence the compressor noise, and give a low intake pressure loss. (d) An exhaust muffler that will partially silence the turbine exhaust noise and give a low exhaust system pressure loss.

The fact that a compartment containing gas turbine engines can be satisfactorily ventilated without the use of ventilation blowers is of significance to those who are interested in the application of this relatively new prime mover. By use of the eductor stack system, a portion of the energy contained in the exhaust gases and which would otherwise be wasted, is put to use in ventilating the compartment and cool-

(*Continued on page* 212)





Test jumper facilitates breaker inspection, operation and maintenance at the station site.

Hard-to-get-at undersurfaces are protected against rust and corrosion by a heavy rubberized sealing material.

Install Switchgear Outdoors

GET CONVENIENT OPERATION PLUS COMPLETE PROTECTION

When building-cost considerations suggest outdoor switchgear installations, you'll naturally want equipment that can be most conveniently operated and maintained in the open . . . and weatherproofed to protect against rust and corrosion. Westinghouse Outdoor Metal-Clad Switchgear meets these specifications.

Convenient Operation and Maintenance — Easily operated horizontal drawout circuit breakers eliminate lifting and lowering. A few turns of a crank connect or disconnect the breaker. Breakers of like rating are interchangeable and are easily rolled on the adjustable-height transport truck with its combination latching device for breaker and stationary structure.

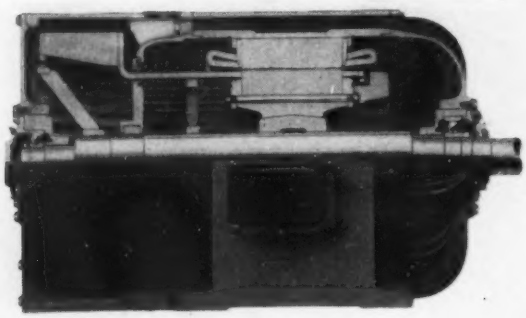
Weatherproof Construction—Utilizing rigid, self-supporting, jig-welded construction features, Westinghouse Outdoor Metal-Clad Switchgear is equipped with a weatherproof housing, special underframe or base, and access doors at both front and rear of the unit. Space heaters and special ventilators in each unit reduce the possibility of condensation. As long-term protection against rust and corrosive elements, the metal frame is Bonderized, prime and finish painted, and the base receives a heavy spray application of all-weather undersurface coating.

For complete facts on outdoor or indoor metal-clad switchgear, write for Booklet 5306. Address: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60793

PLANT EQUIPMENT NEWS

Your information center for new products designed to solve plant problems

Published monthly as a service to readers



High-Slip Motor Has Extended-Bar Construction

236 • New totally-enclosed, fan-cooled high-slip induction motor is designed for use in acceleration of high-inertia loads like punch presses, centrifuges, hoists, etc. Type KRX is as much as 30% smaller and 40% lighter than conventional totally-enclosed fan-cooled high-slip motors.

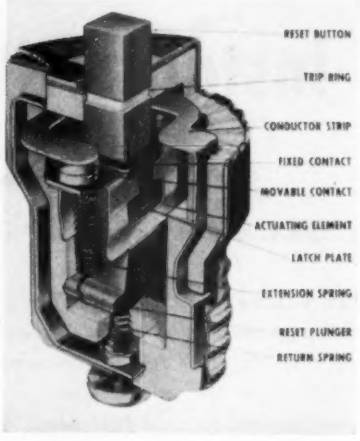
Reduced heating within the motor enclosure allows a normal air gap between rotor and stator. This reduces operating costs because there is no loss of electrical efficiency.

Type KRX motor is available in 30 to 150 hp at 900 and 1200 rpm, 5-8 and 8-13% slip. Voltage ratings are 220, 440 and 550.
General Electric Co, Schenectady, N.Y.

Oilproof Neoprene Tape

223 • Self-affixing neoprene electrical insulating tape provides a splicing medium with high degree of oil and solvent resistance, when vulcanized, plus good dielectric strength and aging qualities, according to the manufacturer. *Bi-Prene* conforms to irregular surfaces when wrapped under normal taping tension, may be cured in a field or factory patching press. Curing time is directly related to depth of the splice section and mold temperature.

Available in 30-ft rolls, .030 in. thick, in standard widths from ½ to 2 in., and in bulk on special order.
Bishop Mfg Corp, 132 Factory St, Cedar Grove, N.J.

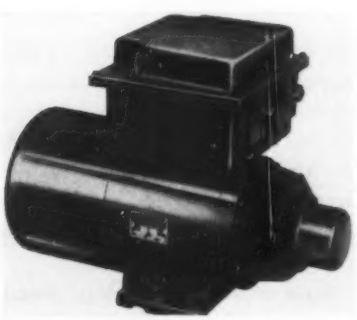


Miniature Circuit Breaker

221 • *Mini-breaker* permanent type protective device fits into any standard Edison base fuseholder delivering up to 125-v ac. It requires no additional equipment and no special wiring when applied to branch or main circuits with 15, 20 or 30-amp ratings. Can be installed in a matter of seconds; electrical service is restored simply by pressing in and releasing the reset button. Device is listed as a circuit protector by Underwriters' Laboratories, Inc.

Unit is precision-built and thermally-actuated. It has 25 parts self-enclosed within a special tamper-proof insulating case. Device safely interrupts excessive overloads and short circuits, tripping instantly on "shorts," but with a built-in time lag to handle temporary starting loads and line surges. Service can normally be restored within 10 seconds after an interruption.
Mechanical Products Inc, 1824 River St, Jackson, Mich.

(*Continued on page* 160)



Electrical Converter

229 • This 300-w, 6120/20 frame converter has dc input of 115 v ± 15% and a 60 cycle, regulated ac output of 115v, single phase, operating at 0.9 lagging power factor. Regulated output is achieved by compounding booster field winding. Output suppresses radio noise by a filter unit on the control box mounted on top.

Unit is totally-enclosed moisture-proof and cooled by a fan that passes cool air over the exterior frame. Base, box, and covers are anodized cast aluminum; cover plates are cadmium-plated steel. Unit is built to MIL specifications to withstand corrosion, fungus, salt spray, etc.
Eicor, Inc, 1501 W Congress St, Chicago 7, Ill.

Commutator-Stone Holder

232 • Type C *Commstone* holder holds stones rigid and true for concentric resurfacing of commutators and slip rings while they run at normal speeds in their own bearings. It is only 3¼-in. wide.

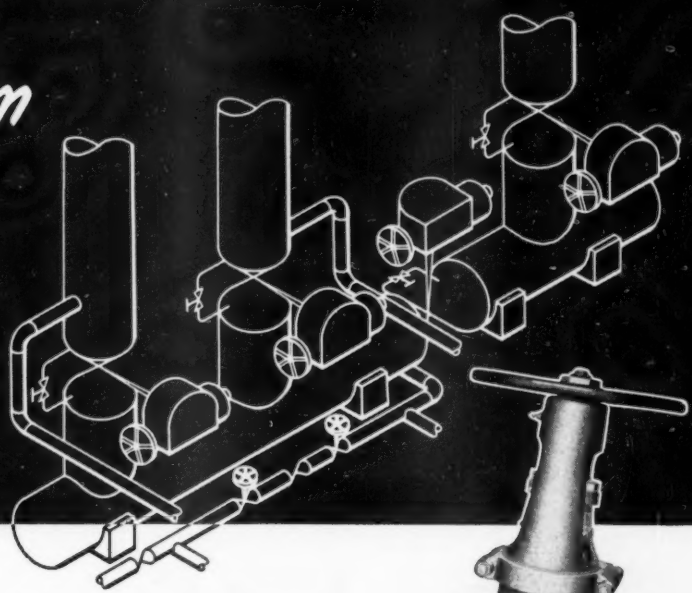
Adjustable support, hinged at center, has insulated bushings for brush-arms ⅝ to 1 in. diameter. Holder can be used as shown when brush-arms are not easily accessible, or it may be taken apart at the center and tool mounted on lower part of support.
Martindale Electric Co, 1385 Hird Ave, Cleveland 7, Ohio

For more data on these items, use post cards p. 167. Identify your request with item number.

It's not what you Pay for Valves ...it's what they Cost you

on Main Steam Lines for example

(A Case History)



What you pay for valves is not the final criterion of value. Not when maintenance costs can quickly equal or exceed purchase price. A thrifty buyer knows his maintenance; knows also there's bigger value in better quality.

Take this case of main steam header valves in a midwestern public utility power station. One header is equipped with bolted bonnet valves. Another in identical service has Crane Pressure-Seal Bonnet Gates of identical size and pressure class.

Records on bolted bonnet valves show considerable repairs for seat leakage, and difficulty in keeping bonnet joints tight. Also trouble with discs sticking shut. In contrast, Crane Pressure-Seal Valves keep giving trouble-free, extra-cost-free service. Seats and bonnets stay tight as new; operation is smooth and positive.

Today, more than ever, you need greater assurance of dependability in piping materials. You get it in Crane valves—the standard of quality with thrifty buyers everywhere. Your big Crane Catalog offers complete selections for all needs. Your Crane Representative is always at your service.

Crane Pressure-Seal Bonnet Valves —gate, globe, angle, and stop check—in 600, 900, and 1500-Pound classes. See your Crane Catalog.

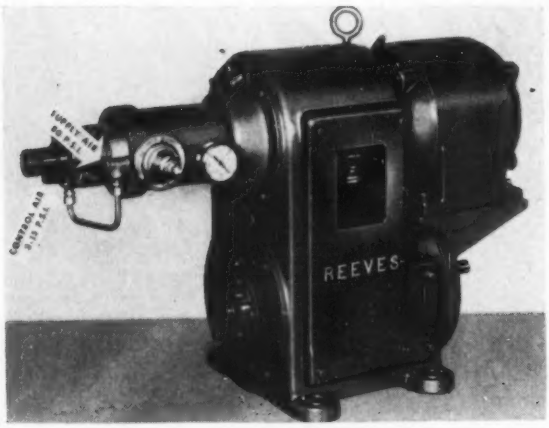
CRANE VALVES

Crane Co., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas.

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

More EQUIPMENT NEWS

Begins on page 158

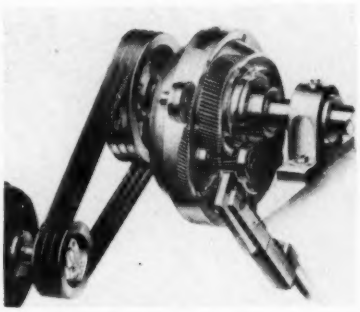


Variable Speed Drive Control

205 • Conoflow control cylinder added to Reeves motodrive permits control of liquid levels in open or closed tanks. It also makes possible automatic control for flow proportioning systems of liquid, gas, chemicals, etc., as well as pressure and temperature.

The Conoflow unit is available on integral horsepower vari-speed drives that use instrumentation air pressure of 3-15 psi. The drives have a 6 to 1 maximum speed range with capacities to 25 hp. Connection is made direct to the Conoflow cylinder from any pneumatic controller. Present air supply in the plant will operate it.

Reeves Pulley Co, Columbus, Ind.

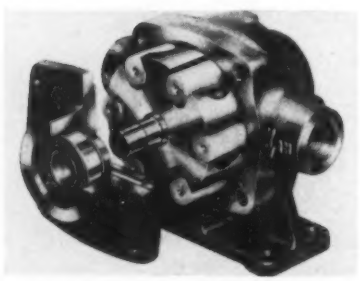


Speed Reduction Drives

241 • *Shaft-king* speed-reduction units have 20.1 ratio, feature improvements in gears, bearings, housing, lubrication and oil sealing systems. Gearing consists of two trains of the single helical type, precision cut from alloy steel forgings. Both ball and tapered-roller bearings are used, and housing is of three-wall construction. Gearing and bearings are continuously splash-lubricated by the high-speed gear and the counter-shaft pinion running in an oil reservoir in the lower third of the housing.

Concentric shaft design places both input and output shaft above oil level so bearing seals do not operate against a head of oil. Interchangeable patented split-tapered bushings with locking nuts make the units immediately adaptable to any shaft size up through 3 15/16 in. Reducers are mounted directly on shaft of driven machine and require only standard shaft lengths (twice shaft diameter plus clearance) for mounting. Units can be equipped with *American* torque-arm overload release. Catalog available.

American Pulley Co, 4200 Wissahickon Ave, Philadelphia 29, Pa.

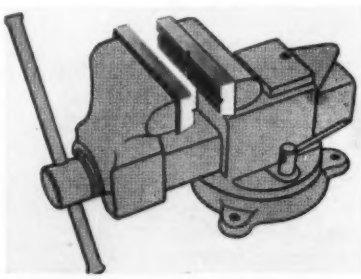


Roller-Type Pump

215 • Roller-type pump, 6000 series, is designed for belt and pulley or direct drive operation on electric motors or gas engines. Unit is specially adapted to handle wettable powder mixtures and emulsified solutions. It is instantly self-priming, delivers approximately 12.5 gpm open discharge at 800 rpm with recommended pressures to 200 lbs.

Pump features *Ni-Resist* case and rotor with nylon rollers for positive liquid displacement and long life, has permanently lubricated ball bearings and stainless steel shaft. Pipe connections are ¾-in. Base plates and solid shaft are furnished for gas engine and belt and pulley drives. Weight is 10½ lbs.

Hypro Engineering, Inc, Dept KP, 404 N Washington Ave, Minneapolis 1, Minn.



Soft Vise Jaws

204 • Magne-Grip soft jaws have built-in permanent magnets, snap into position quickly and easily without holding devices. They can be removed by simply lifting them off. Two-way V-groove locks the work in. Available for vises with 3, 3½, 4, or 4½ in. jaw widths. Manufacturer claims these jaws will not mar delicate finishes.

Magne-Grip Tool Co, 4900 W Madison St, Chicago 44, Ill.

File Set

225 • New set of 18 graded files is micrometer checked to tolerances as low as 0.0004 in. Thicknesses range from .072 down to .009 in., claimed to be the thinnest file made.

Typical uses are for precision slot filing, gap filing of electrical contacts, filing in inaccessible spots. *Micro-Files* can be purchased individually or in sets.

Tacony File & Hardware Co, 2814 N 4th St, Philadelphia 32, Pa.

Seamless Light-Wall Tubing

207 • Maximum OD of manufacturer's seamless light-wall tubing is increased from 1¼ in. to 2-1/16 in. It is furnished in AISI types 304, 321 and 347, and in *Monel* metal; produced in pickled or standard bright finish, and in fully annealed, half- and full-hard drawn tempers. For tubing 1½ to 2-1/16 in. OD, minimum wall thickness is .010, maximum .025.

The increased size range is expected to increase the number of applications, particularly where pressures exceed the limits for welded tubing.

Superior Tube Co, Norristown, Pa.

Liquid Cooler

242 • Unit is said to simplify and speed up boiler blowoff, water sampling and similar operations. It features two copper tube circuits cast in a single aluminum block. Coolers are tested to 1500 psi.

Coolant flows through one circuit; liquid to be cooled flows through the other. Cast-in-aluminum construction permits efficient heat transfer.

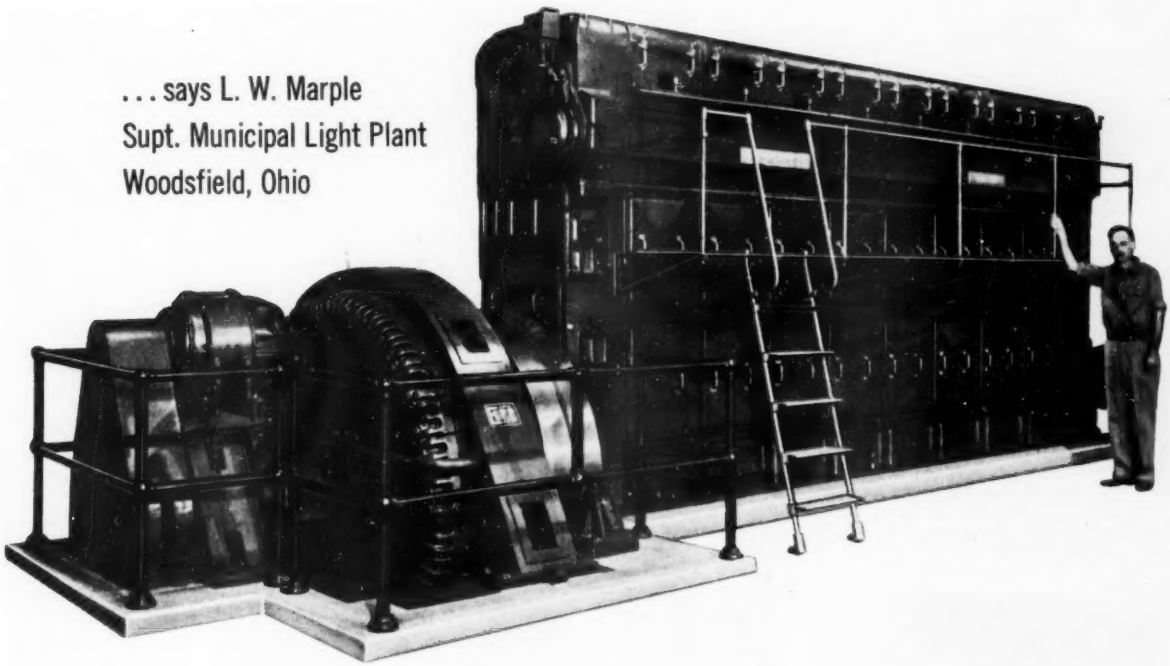
Heat-X-Changer Co, Brewster, N. Y.

(*Continued on page* 162)

For more data on these items, use post cards p. 167. Identify your request with item number.

"No More Sticking Rings!"...

... says L. W. Marple
Supt. Municipal Light Plant
Woodsfield, Ohio



● "Because of the lubricating oil we were previously using," says Mr. Marple, "sticking rings and carbon build-up were persistent problems on our three Fairbanks-Morse Model 32-E diesels.

"Three years ago, at the recommendation of one of your lubrication engineers, we switched to Sinclair GASCON® Oil D — HD.

"GASCON D — HD has cleared up our troubles... no more sticking or broken rings... no more carbon build-up, even though our load factor has increased. The result is a considerable savings in maintenance costs.

"We are also getting outstanding results with GASCON in our new 875 H.P. National Superior Dual Fuel Engine."

Perhaps a Sinclair Lubrication Engineer can solve *your* lubrication problems. Call your local Sinclair Representative or write to Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR

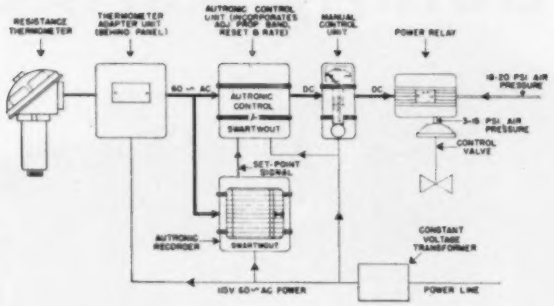
DIESEL

LUBRICANTS

save wear and replacements

More EQUIPMENT NEWS

Begins on page 158



Package Controller and Recorder

222 • New *Autronic* temperature controlling and recording package is composed of a new temperature primary element transmitter, controller, recorder, manual control, power relay, and one or more constant voltage transformers depending on needs of the installation. Manufacturer claims instantaneous and accurate response, unrestricted location of units, adaptability to many different processes, interchangeability of components without recalibration, low intial cost, etc.

Swartwout Co, 18511 Euclid Ave, Cleveland, Ohio.

Electrical Insulating Tape

243 • This self-bonding Type V tape has a dielectric strength over 1000 volts per mil. It is suited for wire and cable splicing, being water-, acid-, alkali-, corrosion- and weather-proofed. It is impervious to ozone and oxygen.

Type V is a polyethylene based compound that fuses into a solid homogeneous mass when applied. It does not depend on an adhesive for bonding and is, therefore, easy to apply in close clearances. It has no right or wrong side, both sides are usable. Tape can be applied as low as –40 F without becoming brittle or difficult to use.

Type V is UL approved as a splice insulation for rubber and thermoplastic insulated wires and cables when temperatures do not exceed 80 C and when covered with friction tape.

It is available in standard widths of ½, ¾, and 1 in., 0.02 in. thick in 30-ft rolls, clear or black.

Bishop Manufacturing Corp, 132 Factory St, Cedar Grove, N. J.

Impedance Bridge

227 • Battery-operated universal impedance bridge, model 250-Cl, is designed for field use. Instrument has laboratory accuracy in measurement of resistors, capacitors and inductors in signal, communication and power systems. Bridge weighs 18 lb, measures 9x11x11 in., complete with battery amplifier.

Measurements can be made over the following ranges: resistance, 1 milliohm to 11 megohms; capacitance, 1 mmfd to 1100 mfds; inductance, 1 microhenry to 1100 microhenrys; storage factor of inductors (Q) 0.02 to 1000; dissipation factor of capacitors (D) 0.001 to 1.0. Accuracy specifications are as follows: resistance, ± 0.10%; capacitance, ± 0.25%; inductance, ± 1%. Bulletin available.

Brown Electro-Measurement Corp, 4635 E Hawthorne Blvd, Portland 15, Oregon

Portable Air Meter

209 • Battery-operated power pack for use with Hastings Air meter includes 6-v battery and converter that provides 110-v ac output. Power pack and meter both fit in hardwood case, make portable unit for measuring air velocities where 110-v supply is not available. Meter has single range from 0 to 6000 fpm, is direct reading type.

Hastings Instrument Co, Inc, Hampton, Virginia

Capacitor Equipment

235 • Open-type, automatically-switched 300-kvar capacitor equipment for 15-kv ungrounded wye or delta systems has basic impulse level of 95 kv. The 25-kvar capacitors are mounted on pedestal insulators to provide increased insulation. For protecting equipment from voltage surges, 15-kv lightning arresters may be used.

General Electric Co, Schenectady 5, New York

Rapid Scanning System

230 • Metrotype system of numerical recording and telemetering makes printed records of process data directly from the primary information. Readings are presented in numerical form tabulated for convenient use on a single page for easy handling and storage. System reads voltage, current, power, temperature, flow or anything else that can be translated to an electrical indication with a suitable transducer. It also sets up an alarm for any abnormal condition.

Messages are stored on teletype tape and read by the tape transmitter. All numerical readings are made from actual primary data. Readings are printed at the rate of one per second, but tape is punched at the rate of 25 digits per second.

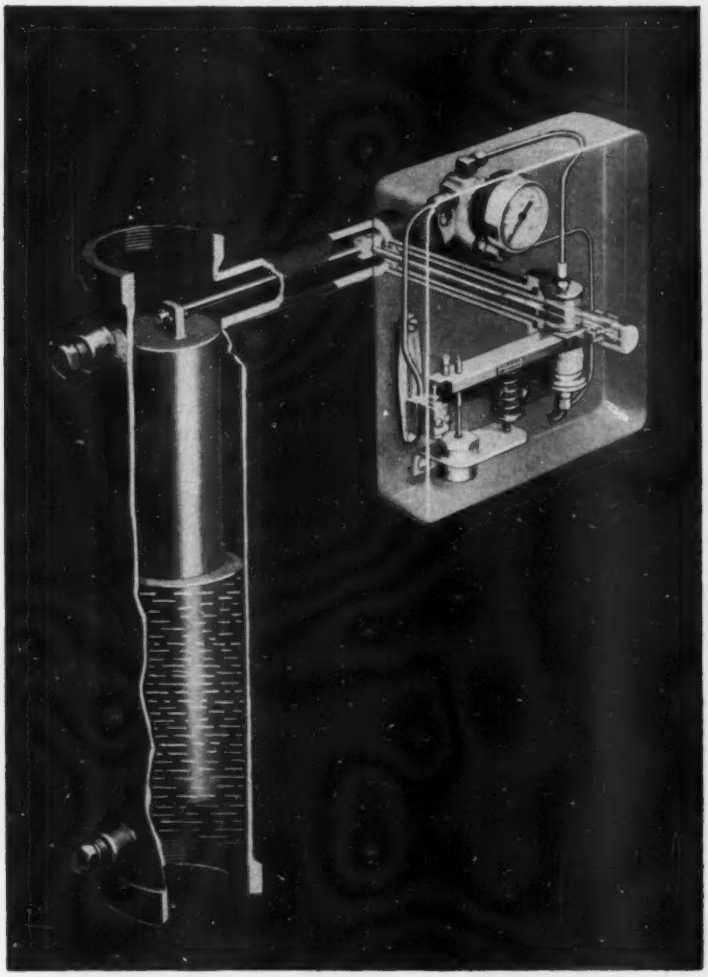
Readings can be printed locally or transmitted any distance, and still be combined on one page.

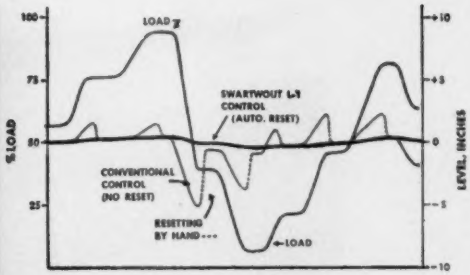
Tigerman Engineering Co, 4332 N Western Ave, Chicago 18, Ill.

(*Continued on page* 164)

For more data on these items, use post cards p 167. Identify your request with item number.

Hold liquid levels within ±1/2 inch automatically with Swartwout L1 Displacement Type Controls



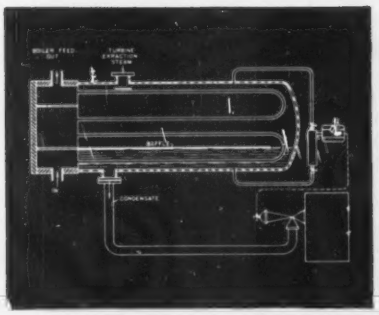


1 Precise control of liquid level from no load to full load without manual readjustment is provided by Swartwout L1 Controls. Setback and reset features compensate for quick-changing loads or long process lags . . . eliminate any tendency to cycle or hunt, yet permit control within narrow range of ±½ inch. Graph *(above)* shows precision of L1 compared with conventional control on applications where level must be maintained within ±½ inch.

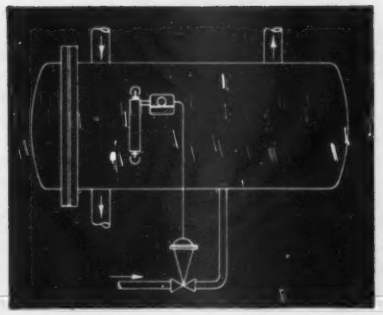
Operating on balance of forces principle, there is little actual movement of parts. Torque tube design eliminates stuffing boxes . . . gives continuous leakproof operation. Since changes in liquid level vary effective weight of displacement type float, L1 Controls can also be used for throttling over full length of float, available in lengths from 15 to 120 inches. A-3886

Swartwout

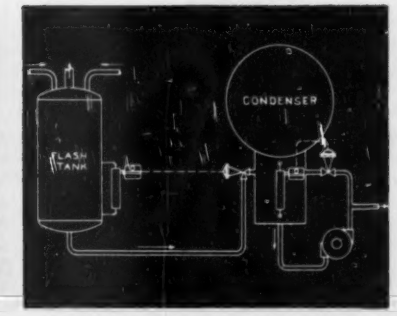
POWER PLANT EQUIPMENT



2 Horizontal Subcooled Heaters—L1 Control holds level to ±½ inch, never lets condensate cover tubes that should be exposed to steam . . . never exposes tubes that should be covered with condensate.



3 Evaporators—Swartwout L1 Displacement Type Control holds level within ±½ inch . . . prevents carryover of solids and contamination of boiler feed water. Increased plant efficiency results.

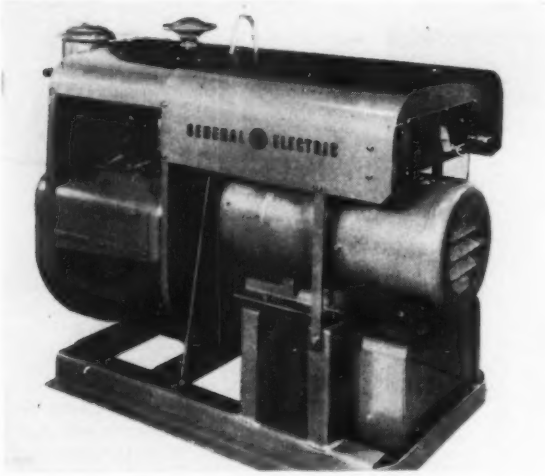


4 Flash Tanks—Level maintained, in some installations, by L1 Control draining to condenser. Hot well level precisely maintained by controlling condensate recirculation from pump discharge.

SEND FOR BULLETINS S-15-A, S-208-A • THE SWARTWOUT COMPANY, 18511 EUCLID AVENUE, CLEVELAND 12, OHIO

More EQUIPMENT NEWS

Begins on page 158



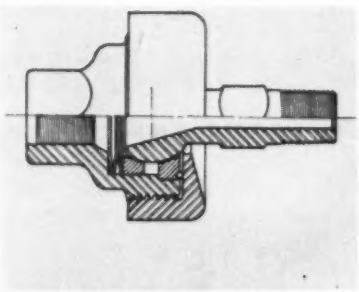
Engine-Driven Arc Welder

231 • New 200-amp engine-driven dc arc welder has a 60% duty cycle. Type WD-42AGW has a current range of 40 to 250 amp, can be used with a variety of electrode sizes for repair, maintenance and construction work.

Unit consists basically of a GE type WD42 generator and a Wisconsin air-cooled engine. It fits crosswise in a standard pickup truck. Optional equipment includes a trailer equipped with fittings for pressure lubrication.

Forced ventilation keeps internal temperature within safety limits when welder is operated on a 60% duty cycle at rated load. Heavy overloads for short periods do not produce harmful results.

General Electric Co, Schenectady 5, N.Y.



Fireproof Ball Joints

244 • Fireproof, all steel, flexible ball joints suitable for working pressures up to 7500 psi (hydraulic) are produced in steel and alloy steel. Design differs somewhat from lower pressure joints in that the inner seal on the ball is a free-floating part carried under constant spring pressure. This insures positive, leak-proof sealing at low or zero pressure and also makes the joint easy to turn and move. Five sizes available: 1, 2, 2½, 3 and 4 in. Bulletin No. 215.

Barco Mfg Co, Dept J-16, 1801 Winnemac Ave, Chicago 40, Ill.

Safety Hat

240 • *Saf-hed-hat* is made of fiber glass, has long life, light weight, built-in comfort. The fiber glass material is highly resilient, will not split, crack or deform. Manufacturer claims this hat meets ASA code for dielectric breakdown and exceeds ASA code for impact resistance.

U.S. Safety Service Co, 1215 McGee St, Kansas City, Mo.

Wire Braided Steam Hose

238 • *Ironsides* steam hose combines wire braided and glass cord construction. Especially developed for finishing work in steel mills, refineries, glass factories, foundries and all types of steam cleaning, this hose features double strength construction. Inner braids of wire give this hose high burst resistance. Glass cord outer braid provides additional strength, as well as a higher degree of insulation.

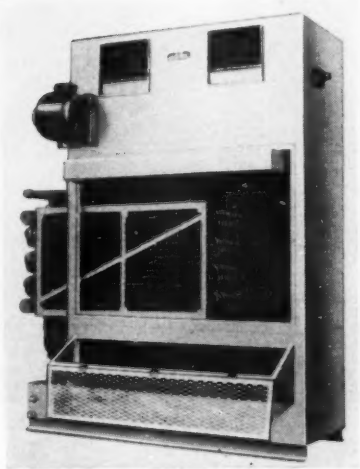
Hose is flexible and kinkproof, and designed for working pressure up to 200 psi. Sizes range from ½ to 1¼ in. inner diameter.

Quaker Rubber Corp, Div of H K Porter Co, Inc, Tacony and Comly Sts, Philadelphia 24, Pa.

For more data on these items, use post cards p 167. Identify your request with item number.

CHECK THESE TOO! . . .

Imprinted Cartridge Fuse . . . . . p 172
High-Voltage Fuse Box . . . . . p 174
Remote Water Cooler . . . . . p 176
Pipe Line Coupler . . . . . p 178
Industrial Crepe Paper . . . . . p 180
Midget Thermostat . . . . . p 182
Universal Air Vent . . . . . p 186
Air-Hydraulic Pumps . . . . . p 188



Evaporative Condensers

208 • Building block construction and removable sectional components provide flexible arrangement and complete accessibility in redesigned line of evaporative condensers. Model ECU is available in six sizes from 7½ to 40 tons. All steel parts are hot-dipped galvanized; heavy gage construction is used throughout. Unit can be disassembled in the field and reset in any of 16 different arrangements.

Condenser is designed primarily for condensing refrigerant gases, but can be used in any other closed-circuit cooling system, like cooling diesel jacket water, transformer oil and quenching and tempering oil installations. Manufacturer claims make-up water does not exceed 2.7 gph per ton of refrigeration.

U. S. Air Conditioning Corp, 3300 Como Ave, S.E., Minneapolis 14, Minn.

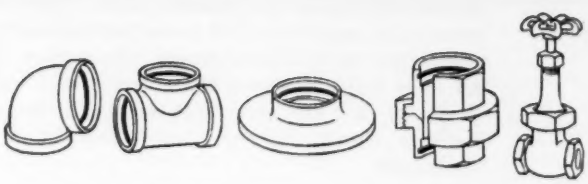
(*Continued on page* 172)

WALSEAL®

COMPLETE LINES OF WALSEAL VALVES AND FITTINGS

WALSEAL is a smooth-bore, bronze valve or pipe fitting having a **factory-inserted** ring of silver brazing alloy in the outlet or outlets. The brazed joint that results when a Walseal product is installed is leakproof, vibration-proof, and corrosion resistant. The alloy fillet that appears upon completion of the joint is visual assurance of **full penetration of alloy.** This improved method of joining brass, copper, or copper-nickel pipe or tube is another Walworth contribution to the progress of the valve and fittings industries.

In addition to its complete line of Walseal products, the Walworth Company manufactures complete lines of valves, fittings, unions, and flanges in a wide range of sizes and temperature-pressure ratings. The company also makes three lines of pipe wrenches, the Genuine Stillson, Walco, and Parmelee. Walworth products total approximately 50,000 items and are sold through distributors or agents in all parts of the world.



The sectioned Walseal tee illustrated, shows: (a) the fillet of alloy that appears upon completion of the Walseal joint. This fillet is your visual assurance of complete penetration. (b) the factory-inserted ring of silver brazing alloy. (c) sectioned view of the completed Walseal joint showing penetration of alloy both ways from the insert. Walseal joints can be made only with Walseal valves or fittings. For further details regarding Walseal products, ask for Circular 84.

SEE OUR CATALOG IN SWEET'S

WALWORTH

Manufacturers since 1842

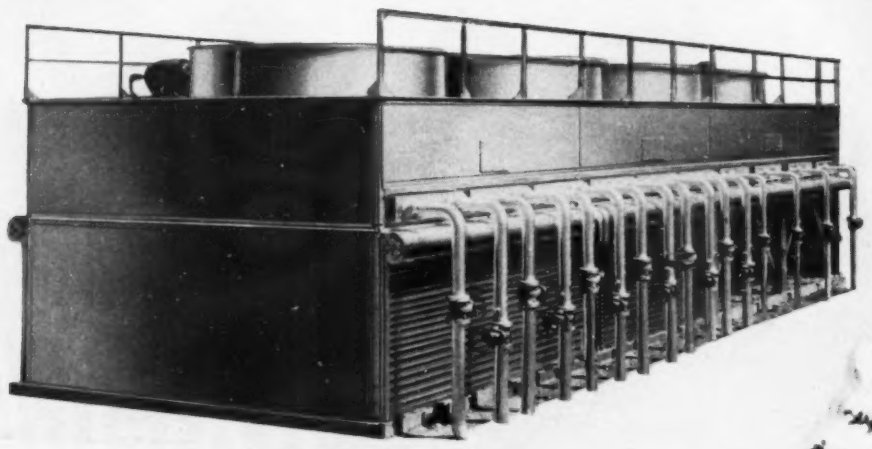
valves . . . fittings . . . pipe wrenches

60 East 42nd Street, New York 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

DRICOOLERS®

take winter in stride...



Maintaining correct process temperatures in all kinds of weather . . . that is the job DriCooler air cooled heat exchangers are engineered to do and they do it! How well they do it is best attested by the experience of DriCooler operators in the Northwest and other sections of the country where sub-zero temperatures are common.

These operators know that DriCoolers in their plants are engineered for any conditions the elements offer. They know that at 30 and 40 degrees below zero there will be no days or nights of intense effort to keep plants running in spite of frozen tube sections, fan icing or similar causes. All have full confidence that their plants will go on delivering gas or electricity in a smooth routine manner because they have the benefit of Marley's broad experience in designing DriCoolers to meet frigid conditions.

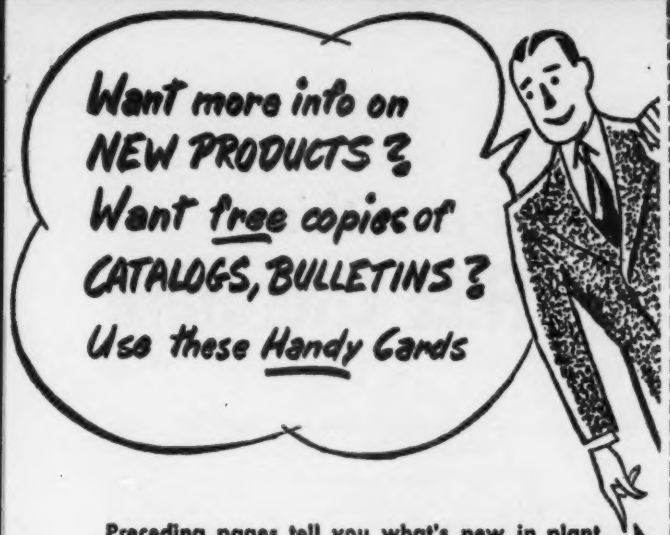
Marley engineering gives as much consideration to low temperatures as to high temperatures. Marley uses (and uses correctly) the most modern techniques to aid the operator in maintaining design temperatures the year round. DriCooler induced draft design protects tube sections by placing them below the plenum chamber where they are not exposed. It keeps the fan in the warm air stream where it cannot accumulate ice. Add to this the control of intake air by easy rolling steel doors or by multi-vane shutters and you have the one air cooled heat exchanger that knows no climatic barriers . . . you have the Marley DriCooler.

Write for a copy of this brochure. It gives very complete information on application of DriCoolers in YOUR business. Address Department DC2.

MARLEY

The Marley Company

Kansas City 5, Missouri



Preceding pages tell you what's new in plant equipment. Each item is numbered. For more info on any of them, write in their numbers here

New free catalogs and bulletins are listed beginning on back of this page. To order those you want, write in their item numbers here

Put 2¢ stamp on self-addressed card and mail it to us. We'll pass along your requests to the various companies, they'll send the info

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- Be sure to write in number of page on which item appeared, and issue of POWER in which you spotted it
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City, State .....

This month's FREE Literature

AIR CONDITIONING, HEATING REFRIGERATION AND VENTILATION

1 **AIR DISTRIBUTORS**—Bulletin F 4471-1 shows line of grilles, registers, cleaning outlets and accessories. 4 pages, illust. Barber-Colman Co, Rockford, Ill.

2 **SURFACE DEHUMIDIFIERS**—Gives construction details, selection procedures, specs and data. 32 pages, illust. Catalog 1660. Westinghouse Sturtevant Div, Dept T-433, 200 Readville St, Hyde Park, Boston 36, Mass.

3 **VANEAXIAL FANS**—16-page Bulletin J-611 describes Axivane series 1000 fans, 136 models, 18 to 84 in. in diameter, volumes to 150,000 cfm at pressures to 11 in. wg. Joy Mfg Co, Oliver Bldg, Pittsburgh 22, Pa.

4 **HEATING SYSTEMS**—Booklets on vapor and vacuum systems, reevaporation, radiator traps, vapor controls and trap maintenance. Catalog 77, Bulletins R-44, C-34, E-45, etc. Barnes & Jones, Inc, 206 Eustis St, Boston 19, Mass.

BOILERS AND AUXILIARIES

5 **GAS & OIL BURNERS**—50 to 900 hp (1660 to 30,000 lb per hr), 15 sizes, 4 gas pressures, all grades of fuel oil, packaged and preassembled, automatic, safety controls. 8 pages, illust. Bulletin P-152. Coen Co, 40 Boardman Pl, San Francisco 3, Calif.

6 **PRECIPITATOR**—Design features of Cottrell precipitator for paper industry. 4 pages, diagram. Research Corp, Bound Brook, N. J.

7 **DUST CONTROL—Industrial Dust Control and Recovery**, new 40-page Bulletin 800, gives technical information and data, description and specs. Illust. Dracco Corp, Harvard Ave & E 116th St, Cleveland 5, Ohio.

8 **DUAL-STAGE BURNER**—Combining steam and mechanical atomization, capacities 80 to 300 gph. 4 pages, illust. Bulletin 25. National Airoil Burner Co, 1284 E Sedgley Ave, Philadelphia 34, Pa.

9 **REFRACTORY**—Thin, interlocking tiles for water walls, baffles, roof coverings. 8 pages, specs. Laclede-Christy Co, Arcade Bldg, 812 Olive St, St. Louis 1, Mo.

10 **ELECTRODE RAPPER**—Magnetic impulse continuous precipitator electrode rapping system. Operation principle, major components. 6 pages, illust. Bulletin MI. Research Corp, Bound Brook, N.J.

11 **BOILER-BURNER UNIT**—Kewanee boiler, Iron Fireman burner in package unit, 52 to 456 hp, 125 to 150 psi. 12 pages, illust. Form 2314. Kewanee-Ross Corp, Kewanee, Ill.

COMPRESSORS AND ACCESSORIES

12 **OIL-FREE COMPRESSORS**—Illust with specs on line of non-lubricated compressors, 172 to 5800 cfm, 25 to 600 hp. 4 pages. Bulletin A-92. Joy Mfg Co, Oliver Bldg, Pittsburgh 22, Pa.

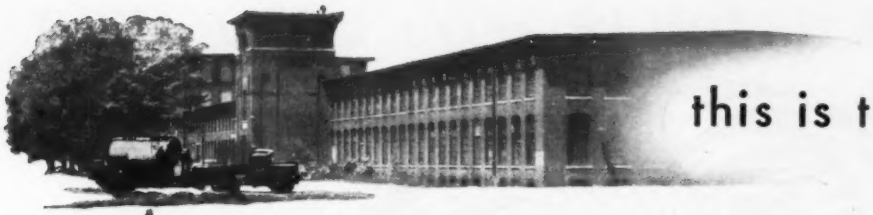
13 **RECIPROCATING COMPRESSORS**—Multistage multi-cylinder units from 100 to 5,000 hp. Design, lubrication, control, drives, applications and specs. 44 pages, illust. Bulletin M-70. The Cooper-Bessemer Corp, Mount Vernon, Ohio.

ELECTRICAL CONTROLS

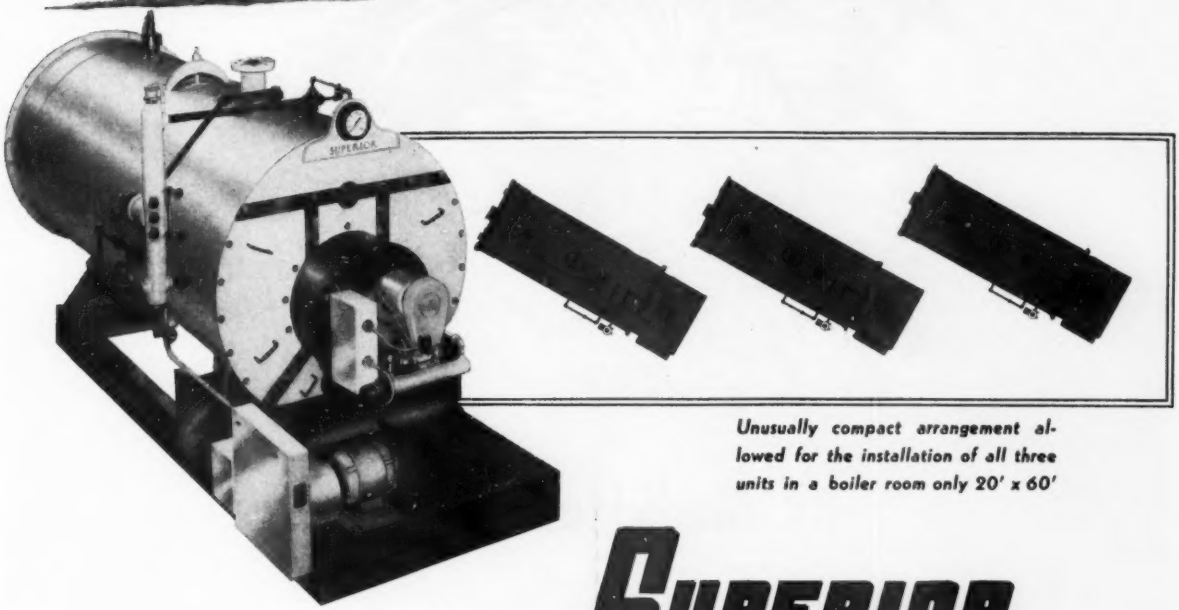
14 **FLOAT CONTROLS**—Program operation of 2 to 18 circuits with single float. 4 pages, illust. Bulletin 3500. Automatic Control Co, St. Paul 4, Minn.

15 **FURNACE ATMOSPHERE**—Automatic control and record of carbon potential in furnace atmosphere. 4 pages, graphs. Lindberg Engrg Co, 2450 W Hubbard St, Chicago 12, Ill.

(Continued on page 236)



this is the plant . . .



Unusually compact arrangement allowed for the installation of all three units in a boiler room only 20' x 60'

. . . . where 3 SUPERIOR STEAM GENERATORS earned more than their cost in less than 2 years

Only four years ago, this plant was inadequately heated with coal at a fuel cost (excluding labor) of approximately $44,000. per year. Three years ago, three Superior Steam Generators were installed with the following three results:

(1) *Fuel costs were cut to $22,000 . . . and in less than two years, those Superior Steam Generators earned more than their total cost.*

(2) *The ability of those Superior Steam Generators to deliver their full rated capacities provided steam in excess of that required for heating . . . which was sold as process steam to increase the earnings of this new steam plant.*

(3) *Because of their compact design, a substantial saving in space resulted; and the space thus saved was profitably rented to still further increase the earnings of this steam plant.*

To meet increased demands for process steam, a fourth Superior Steam Generator has recently been installed.

This is but one of the many case studies which demonstrate the advisability of investigating the installation of Superior Steam Generators in your plant. For complete details write for Catalog 501.

Superior Steam Generators are fully automatic; burn oil, gas, or both. 18 sizes from 20 to 600 b.h.p. for pressures up to 250 p.s.i. or for hot water.

for performance you can **BANK** *on*

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

SUPERIOR STEAM GENERATORS

Medicine Man

This fierce looking African medicine man is a jack-of-all-trades. He claims to talk with the gods, placate angry spirits, exorcize the devil, drive away evil spirits, cure complicated diseases, make rain, interpret dreams—and, for good measure, divine the future.

You don't believe any one person—especially an ignorant savage—can do all these things? Well, maybe you don't, but I can show you a lot of gullible plant owners, power engineers and operators who swallow bunkum just as impossible.

For example, I've operated in, or visited plants where good hard American dollars are shelled out, year after year, for all kinds of fancy-sounding "cure all" boiler-water treatment.

Engineers who would laugh at a medicine man, go right ahead and let his kind take care of their highly sensitive and expensive boilers.

While most firms selling boiler-water treatment chemicals and apparatus are highly reliable, some outfit is always trying to crash the party with a fancy sounding, but nearly worthless product. It's your job to make him give reasonable proof before acting as his guinea pig. A reliable product thrives on intelligent investigation. A cure-all shrivels up and fades away.

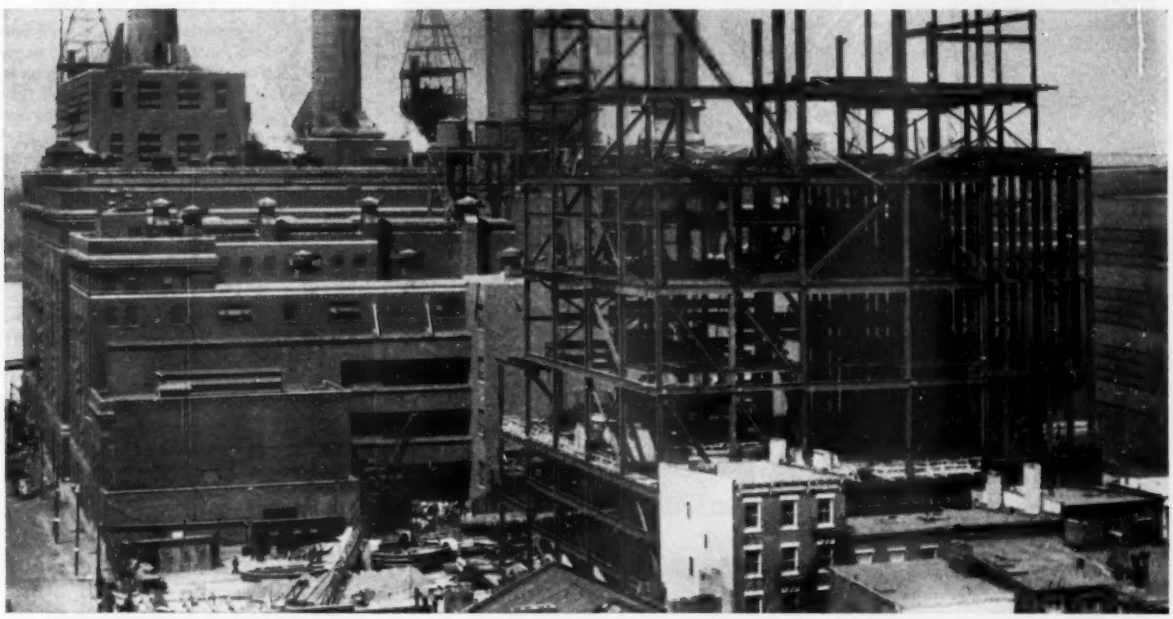
Only witch doctors and medicine men claim to master magic. Let them do their stuff in the jungle—your boilers are too vital for peak production demands just now.

George Edwards

Engineer

CHEMICAL CLEANING REMOVED MILL SCALE FROM BOILER AFTER ERECTION

Dowell service gave quick, effective cleaning assuring more efficient operation



To provide more extensive service for its customers, a large power company installed a new 1,370,000 lb. per hour boiler. Specifications on this equipment called for Dowell Chemical Cleaning Service to remove the mill scale from the boiler *after erection*.

To remove the mill scale, Dowell engineers filled the boiler with solvents especially designed for the job. Using Dowell's equipment, manpower, and pump trucks, the entire cleaning job was performed in a few hours.

The removal of mill scale *after* equipment is erected can eliminate much of the extra care required in the handling of previously sand blasted or pickled tubes. It may also substitute for the grease-removing alkaline pre boil, thus saving considerable time and money. Unless it is removed, mill scale may retard heat transfer, slough off abrading particles, and act as a base for further corrosion.

Maintenance engineers in industrial plants throughout the country have learned to rely on Dowell Service for fast, effective and economical cleaning of their operating equipment. How about you?

Experienced Dowell engineers are available to make estimates on your particular problems. Call Dowell today, or write directly to Tulsa, Dept. B23.

DOWELL SERVICE

Over 100 Offices to Serve You with Chemical Cleaning for:

Boilers • Condensers • Heat Exchangers • Cooling Systems
Pipe Lines • Piping Systems • Gas Washers • Process Towers
Process Equipment • Evaporators • Filter Beds • Tanks

Chemical Services for Oil, Gas and Water Wells

DOWELL INCORPORATED • TULSA 1, OKLAHOMA

DOWELL

A Service Subsidiary of
THE DOW CHEMICAL COMPANY

Only Genuine

RIGID

PIPE WRENCHES

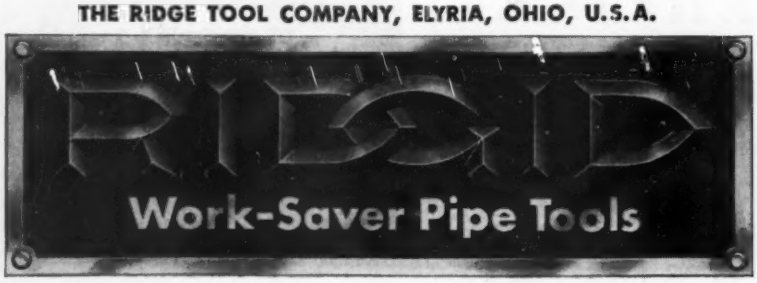
Guarantee you against wrench housing trouble and expense

Look for the wrench with that guarantee label to make sure you get the extra-easy work and extra durability that have made RIGID the world's most popular wrench.

Only RIGID assures you a hookjaw that always rides freely in the housing; adjusting nut always spins easily to pipe size. Replaceable alloy jaws won't slip or lock on pipe. Handy pipe scale on hookjaw. Safe stout comfort-grip I-beam handle.

Save work and money—buy genuine RIGIDs at your Supply House.

THE RIDGE TOOL COMPANY, ELYRIA, OHIO, U.S.A.



More EQUIPMENT NEWS

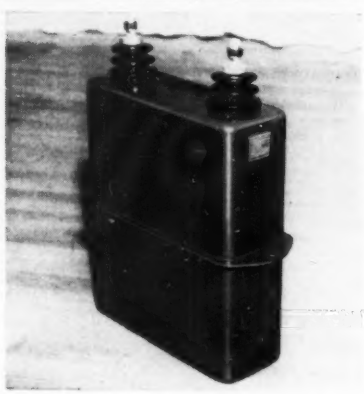
Begins on page 158

Imprinted Cartridge Fuse

217 • Direct machine printing on the barrel of the fuse replaces old-fashioned paper labeling on one-time fuses with clear, clean markings. Color bands around the tube indicate voltage; Underwriters' label, voltage, type, catalog number and name of manufacturer are clearly visible. The printing is unaffected by temperature, humidity, moisture or ordinary chemical atmosphere. Dirt and dust can be wiped off without harm to the labeling.

Chase-Shawmut Co, Newburyport, Mass.

For more data on these items, use post cards, p. 167. Identify your request with item number.



Secondary Network Capacitor

211 • New 7.5 kvar capacitor is designed for secondary network system voltages and the occasional high temperatures and submersion conditions encountered in vaults. Unit is specifically designed for economical application to networks rated 208 and 216 v, operates in ambient temperatures as high as 55 C.

Capacitor weighs less than 75 lb, can be installed on a vault wall above transformers and other equipment, or on the ceiling or floor. Standard ID case has a protective outdoor paint finish. Hangers for six units are available.

General Electric Co, Schenectady 5, N.Y.

Industrial Batteries

201 • *Exide-Tytex*, type COE batteries are available in two- and three-cell construction. They are light-weight with transparent polystyrene containers, and charge indicators. Two-cell units are made in both end-to-end and side-to-side assemblies, three-cell batteries in side-to-side construction. End-

Complete Seating Contact!

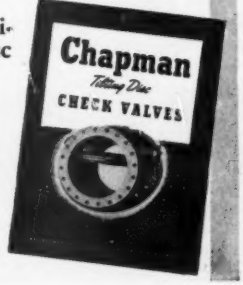
You know you've got it with . . .

CHAPMAN

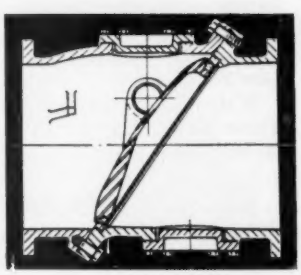
Exclusive TILTING DISC *Check Valve*

Nothing can "unseat" the disc-ring of this valve from its *drop-tight* contact with the body-ring . . . because clearance at the hinge-pins means that this contact is *complete.* There is no sliding action, consequently no wear, no leakage. And the pivoted disc is cushioned to an easy, silent closing . . . without slam . . . in installations that don't have unusual piping arrangements.

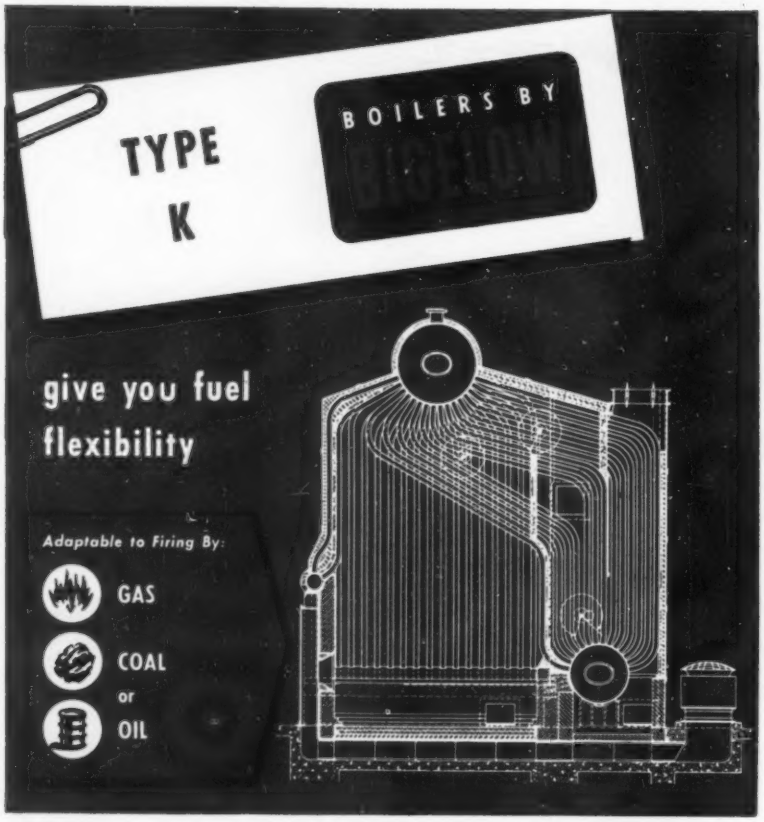
What's more, hydraulic laboratory tests at a top engineering school prove that the specially designed disc and streamlined valve-body reduce head loss, as much as 80% under conventional swing-type check valves. See the graphs of these tests . . . and illustrations of the unique construction features of Chapman Tilting Disc Check Valves . . . in Catalog No. 30 (yours for the asking). *Write.*



THE CHAPMAN VALVE MFG. CO.
INDIAN ORCHARD, MASSACHUSETTS



Cross-section of the Chapman Tilting-Disc Check Valve. A feature of the design is that the disc seat lifts away from the body seat when opening, and drops into contact when closing, with no sliding or wearing of the seats.

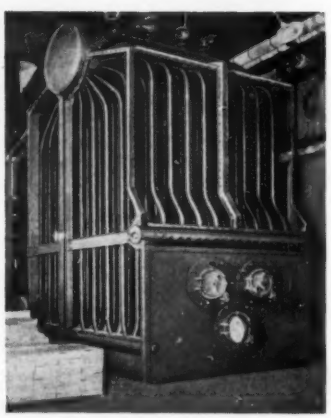


The construction facilitates conversion from oil to coal or coal to oil with minimum cost. The boiler design provides ample furnace volume for the various fuels.

Type KS Water-Tube Boilers By Bigelow are built in sizes ranging from 20,000 to 45,000 lbs. of steam per hr. Type KL Boiler sizes range from 35,000 to 70,000 lbs. of steam per hr. Type KV Boiler sizes range from 70,000 to 100,000 lbs. of steam per hr.

Compact—Low Maintenance—Low Fuel Cost.

Write for free catalog on the Types KS & KL or on any of the boilers listed below.



Bigelow Type KS-18 during erection at the E. & J. Gallo Winery, Modesto, Calif. Capacity 26,000 lbs. steam per hr., oil fired.

BOILERS BY BIGELOW

Water Tube Boilers — Bent Tube Types • Horizontal Return Tubular Boilers • Scotch Type Boilers • Two-Pass Boilers Electric Steam Generators

THE BIGELOW COMPANY • NEW HAVEN 3, CONN.

BIGELOW REPRESENTATIVES: Boston • New York • Chicago Philadelphia • Syracuse • Detroit • Atlanta • Milwaukee New Orleans • Oklahoma City • Petersburg, Va. • Washington, D. C. San Francisco • Los Angeles • Seattle • Knoxville

More EQUIPMENT NEWS

Begins on page 158

to-end units are 8-in. wide, 8½-in. high: side-to-side assemblies are 4¼ wide by 8½ high. Capacities at the 8-hr rate range from 10 to 30 ampere-hours. Uses include signaling, emergency lighting, other stationary small-power applications. Bulletin available. **Electric Storage Battery Co, Box 8109, Philadelphia 1, Pa.**

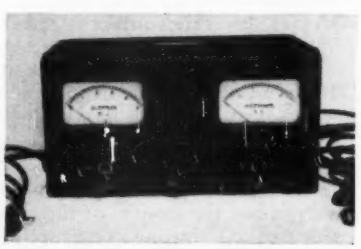
High-Voltage Fuse Box

234 • Gang-operated disconnect method de-energizes fuses on high-voltage motor control. *Safuse* compartment uses a movable panel on which current-limiting fuses are gang-mounted. Fuse panel has disconnecting blades behind the panel.

When fuse compartment door is opened, fuse panel is automatically pulled to the front of the compartment, disconnecting panel from line and putting fuses within easy reach. Operator can then safely and easily remove and replace fuses without a hook stick.

Mechanical and electrical interlocks prevent fuse disconnects when switch is closed and prevent closing motor switch with door open. Target indicators on door tell whether motor switch is opened or closed and whether fuse panel is connected or disconnected. Bulletin 3300-PRD-211.
Electric Machinery Mfg Co, Minneapolis 13, Minn.

For more data on these items, use post cards p 167. Identify your request with item number.



Insulation Tester

233 • Model 424 *hypot* is designed for electrical insulation tests requiring various potential stresses. It permits calculation of dc resistance based on test voltage and out-

you DETERMINE THE COST OF cold

WHEN cooling water is manually controlled, the operator usually plays safe by running with everything wide open. Result—*overcooling*.

WHEN YOU OVERCOOL IN	YOU PAY MORE
1. Internal Combustion Engines and Compressors	by lower efficiency by impaired lubrication
2. Process work	by wasting 50% or more of cooling water used by increasing rejects
3. Refrigeration	for compressor power. For example, it costs 15% more to cool milk to 37°F than to 40°F.

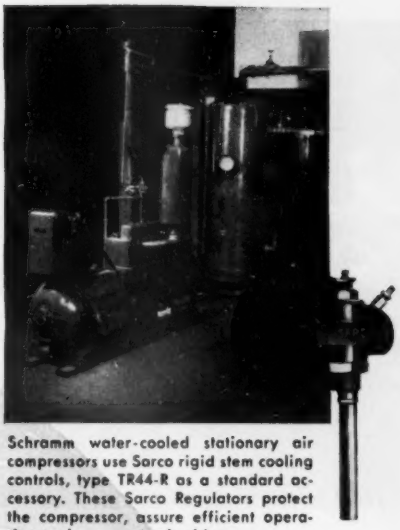
Sarco dependable, self-operated cooling controls prevent overheating and overcooling and assure maximum efficiency at minimum cost.

Four typical examples are shown in our illustrations. Hundreds more are in our files.

Ask for Catalog 700-13. Sarco Company, Inc., Empire State Bldg., New York 1, N. Y. Represented in principal cities. Sarco Canada Ltd., Toronto 8, Ontario.

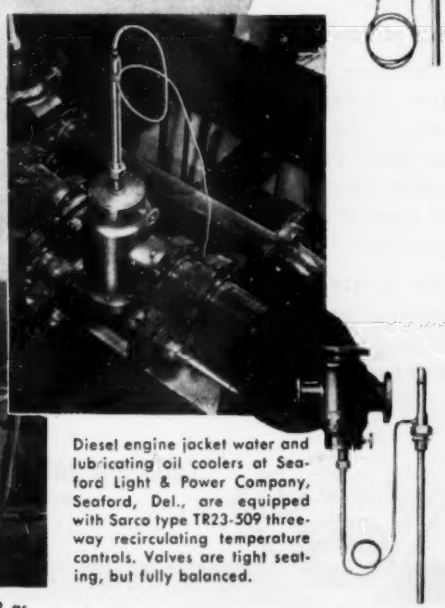
SARCO saves steam

a sarco regulator for every job

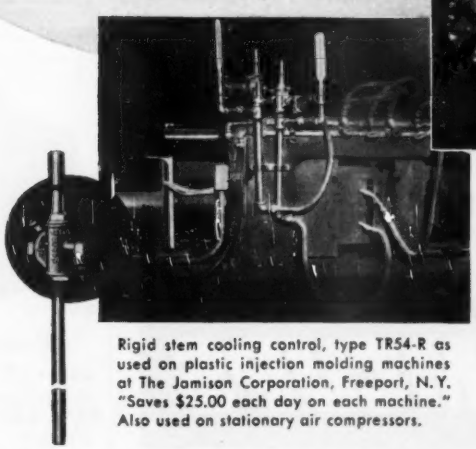


Schramm water-cooled stationary air compressors use Sarco rigid stem cooling controls, type TR44-R as a standard accessory. These Sarco Regulators protect the compressor, assure efficient operation and save water besides.

At Farmers' Chemical Laboratory, Kalamazoo, Mich., cooling water to this still condenser is held at desired temperature by the Sarco type TR21-R control.

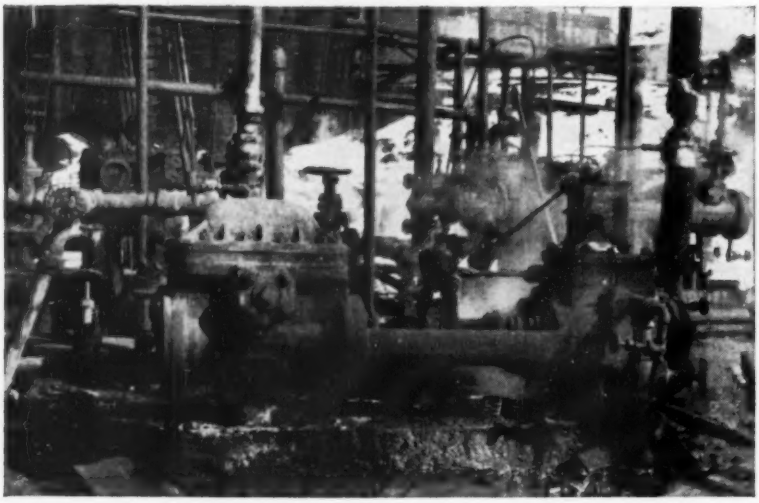


Diesel engine jacket water and lubricating oil coolers at Seaford Light & Power Company, Seaford, Del., are equipped with Sarco type TR23-509 three-way recirculating temperature controls. Valves are tight seating, but fully balanced.



Rigid stem cooling control, type TR54-R as used on plastic injection molding machines at The Jamison Corporation, Freeport, N. Y. "Saves $25.00 each day on each machine." Also used on stationary air compressors.

430



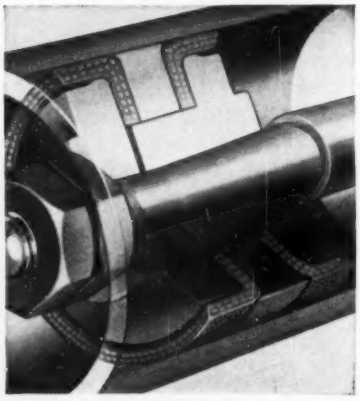
"CHAMBER OF HORRORS"

—for anything but a DARCOVA PUMCUP!

"HOW tough can life get", says ordinary packing inside this pump. Yet, year after year this pump is required to handle acid treated oil products from the base of a heated still to the next purifying process.

Ordinary packing would soon allow slippage to occur—but not Darcova Pumcups. Pumcups retain their efficiency even when severely worn. This installation has operated efficiently for over eight years.

No matter how tough your pumping problem may be, you can do it more efficiently and for lower cost with Darcova Pumcups!



Cross section showing Pumcup installed.

Write for free bulletin No. 4401 on how Pumcups can help solve your pumping problems!

DARCOVA
THE ORIGINAL COMPOSITION CUP

DARLING VALVE & MANUFACTURING CO.
WILLIAMSPORT 8, PA.

PUMCUPS

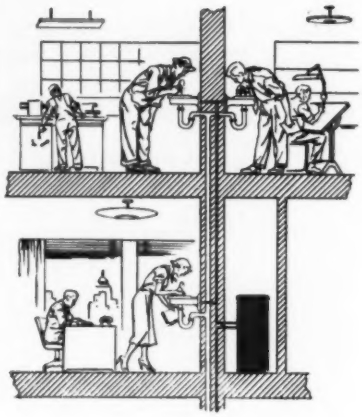
More EQUIPMENT NEWS

Begins on page 158

put current flow. Ammeter is protected against damage by output short circuit, ac ripple is within 1%.

Range is 0-5000 v dc, 0-5-10-50 and 100 microamps. Special models can be furnished with ranges up to 7500 v and within 5 microamps to 2 milliamps.

Associated Research, Inc, 3796 W Belmont Ave, Chicago 18, Ill.



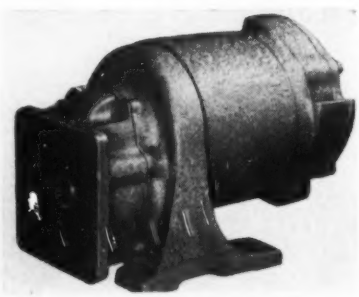
Remote Water Cooler

245 • Air-cooled model WAP7A for stores and offices will supply 12.1 gph of 50 F drinking water where inlet temperature is 70 F, room temperature 80 F. Water-cooled model WWP13 for factories where demand is heavier will supply 21.2 gph under similar conditions.

Water cooling chamber is brass with interior surface heavily tin-plated. Refrigerant coils are copper. Chamber is insulated by granular cork sealed in an air and moisture-tight enclosure. All water-carrying parts are insulated to eliminate sweating, and the refrigerating elements carry a 5-yr guarantee.

Westinghouse Electric Appliance Div, 653 Page Blvd, Springfield 2, Mass.

For more data on these items, use post cards p. 167. Identify your request with item number.

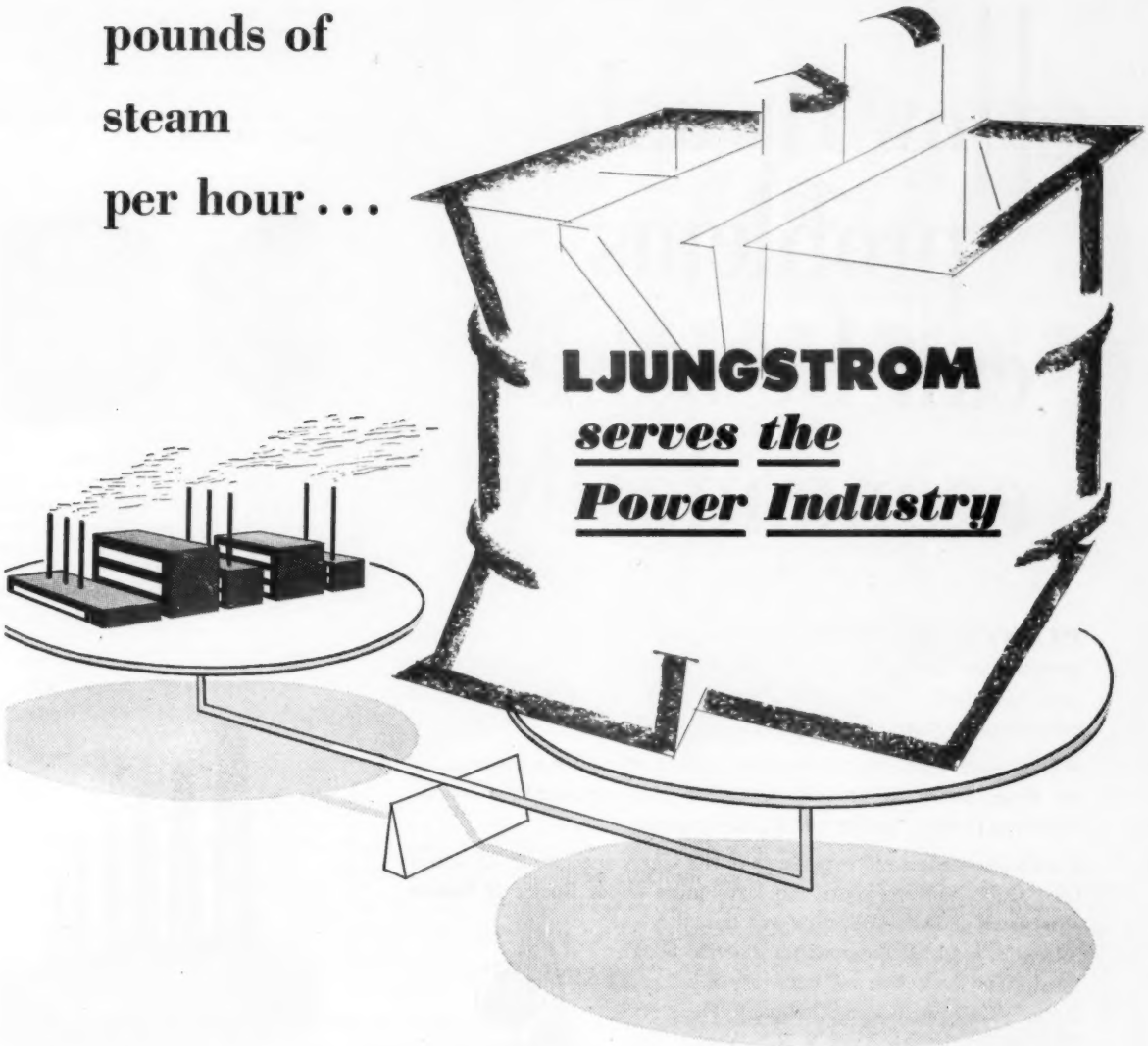


Geared AC Aircraft Motor

246 • 2-hp 400 cycle, 3-phase ac aircraft motor, type GA is rated for continuous duty, has internal gearing that provides multiplied torque at low speeds for driv-

347,000,000

pounds of steam per hour . . .



In the post-war rush to expand power generating facilities, utilities have not lost sight of the need for *operating economy*. Increasingly over these years, the fuel-saving, performance-improving potentials of the Ljungstrom Air Preheater have been realized – until today, nearly two out of every three power boilers are ordered with the specification "Ljungstom Air Preheater."

Since 1946 alone, in fact, more than 347,000,000 pounds per hour of steam capacity – installed or on order -- have been designed for Ljungstrom.

This record speaks for itself. It proves that the Ljungstrom Air Preheater is, indeed, *the most efficient heating surface in the modern boiler.*

The AIR PREHEATER CORPORATION

60 East 42nd Street, New York 17, N. Y.

Your Management wants to know...

How fly ash problems can be solved economically!

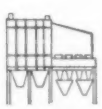
PLANT ENGINEERS, working with Buell engineers, have proven again and again that their know-how coupled with Buell's long experience in Dust Collection can solve your Fly Ash problems more economically, more efficiently.

What's more, Buell Dust Collection Systems offer all American industry these further advantages: smoother plant-community relations, improved product quality and higher employee morale.

Buell's knowledge and experience in the highly specialized science of Dust Collection are yours. To learn more about Buell's **3 basic systems** of Dust Collection and how they can help you, send for the new, informative booklet titled, "The Collection and Recovery of Industrial Dusts." Buell Engineering Company, Dept. 50-B, 70 Pine Street, New York 5, New York.

Van Tongeren Cyclone

'SF' Electric Precipitator



Precipitator Cyclone Combination

Type 'LR' Collector

Dust Hopper Valves

ELECTRIC CYCLONIC

buell

ENGINEERED EFFICIENCY IN DUST COLLECTION

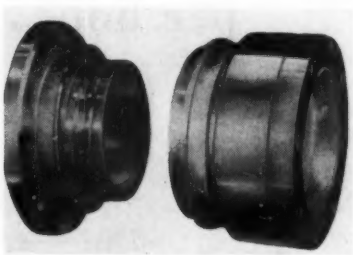
More EQUIPMENT NEWS

Begins on page 158

ing pumps, compressors, hoists, etc. Output speeds range from 1500 to 5000 rpm.

Features include hardened and shaved helical gears, integral fan for self-ventilation, internal spline take-off shaft.

U. S. Electrical Motors, Inc, Aircraft Div, Terminal Annex, Box 2058, Los Angeles 54, Calif.



Pipe Line Coupler

214 • New *Snap-Tite* coupler has valve that shuts off liquid flow when nipple is removed. Any operator can make or break connection by merely sliding a sleeve. Sizes from ¼ to 8 in. In sizes up to 3 in., couplers are designed for screwed fittings; over 3 in. with screwed or flanged fittings. All couplers swivel 360 deg.

Snap-Tite, Inc, Union City, Pa.

Screw Extractors

203 • Extractors remove broken screws, bolts, studs or other threaded forms without injury to the tapped threads. Available in 9 sizes and in sets, complete with maple block stand.

J H Williams & Co, Buffalo 7, N.Y.

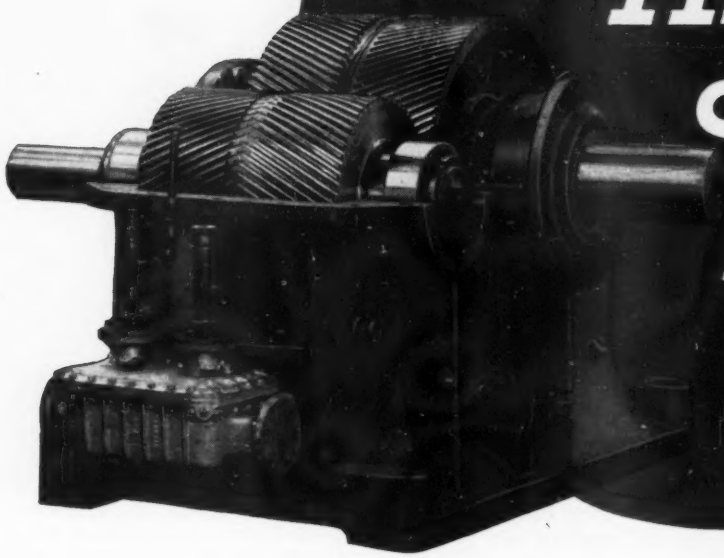
For more data on these items, use post cards p. 167. Identify your request with item number.

Soldering Paste

239 • *Hy-tin* is a paste containing powdered solder suspended in a powerful scavenger action flux that cleans and tins in the same application cast iron, stainless steel, monel, cast steel, copper, brass, gal-

FOR TURBINE APPLICATIONS AND OTHER

HIGH SPEED DRIVES

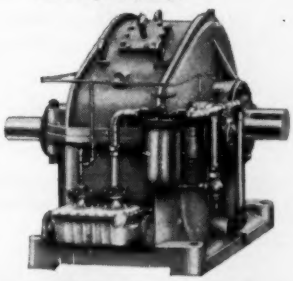


Philadelphia High Speed Units have been developed for applications where shaft speeds and pitch line velocities exceed the limit for standard parallel shaft gear units. A growing list of users indicate their satisfactory and dependable performance on turbine reduction drives to pumps and other machinery, also as speed increasers from low speed engines to high speed pumps or fans.

Gears are double-helical type, accurately cut and shaved to balance thrust reactions. Special high speed bearings keep gears in proper alignment. Lubrication is force-feed type. Heat generated in high speed operation is dissipated by a water-cooled heat exchanger. Balanced Gears combined with rigid bearing mountings keep noise and vibration to a minimum. Units available for complete range of speed and horsepower applications.

For full details send for our Bulletin 300.

Illustrations show open and closed views of typical drive designed to continuously transmit 1400 h.p. from a 3000 r.p.m. turbine to a 1200 r.p.m. pump.



Philadelphia Gear Works, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.

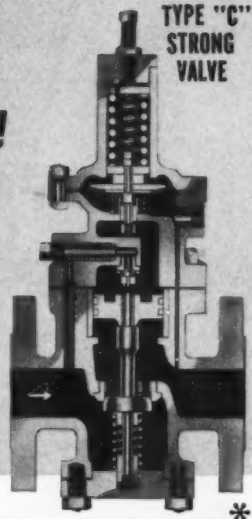
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

GET THIS VALVE!

Accurate pressure regulation!

TYPE "C" STRONG VALVE



FOR HEATING OR PROCESS JOBS:

- ... with intermittent or fluctuating demand;
- ... requiring accurate control;
- ... where dependability is essential.

For positive control, use this STRONG* single-seated, pilot-controlled valve!

Simple design, extra-heavy construction make STRONG's Type "C" regulating valve give trouble-free regulation. Semi-steel for pressures to 250 psi, 450° F.; cast steel to 600 psi, 750° F. With Anum-Metl† seat and disc, this valve automatically adjusts itself to control the flow of steam, air or gas required to maintain reduced pressure.

Write us about your pressure reducing problem or request our complete steam specialties Catalog 68-X.

TYPE "O"

Direct operated. Semi-steel construction suitable for initial pressures to 225 psi, 400° F. For steam, air, water or gas.

Features internal strainer, Anum-Metl† seat and disc. Direct operated, of extra heavy semi-steel, this valve is suitable for pressures to 225 psi, 400° F.

TYPE "K"

*Trade Mark Reg. U. S. Pat. Off.

STRONG, CARLISLE & HAMMOND COMPANY

1392 WEST 3rd Street
Cleveland 13, Ohio

† ANUM-METL Reg. Trade Mark

OTHER STRONG STEAM SPECIALTIES

No. 070 Small Trap

"SY" Strainer

800 Series Steel Trap

STRONG

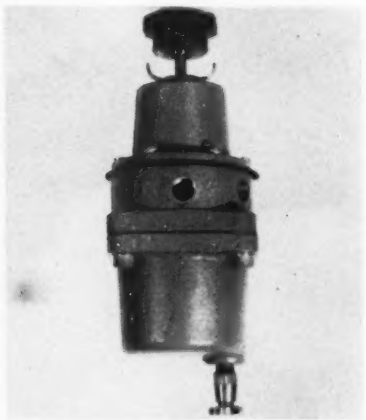
More EQUIPMENT NEWS

Begins on page 158

vanized and lead coated steel. Flux is stable and non-active at normal temperature. At soldering temperature it turns liquid and is powerful enough to remove the scale and tin black iron.

Manufacturer claims these advantages: no metal and flux separation, no sputtering when applied to heated metal, no drying and caking.

Farrelloy Co, 1220 N 26th St, Philadelphia 21, Pa.



Combination Pressure Regulator and Filter

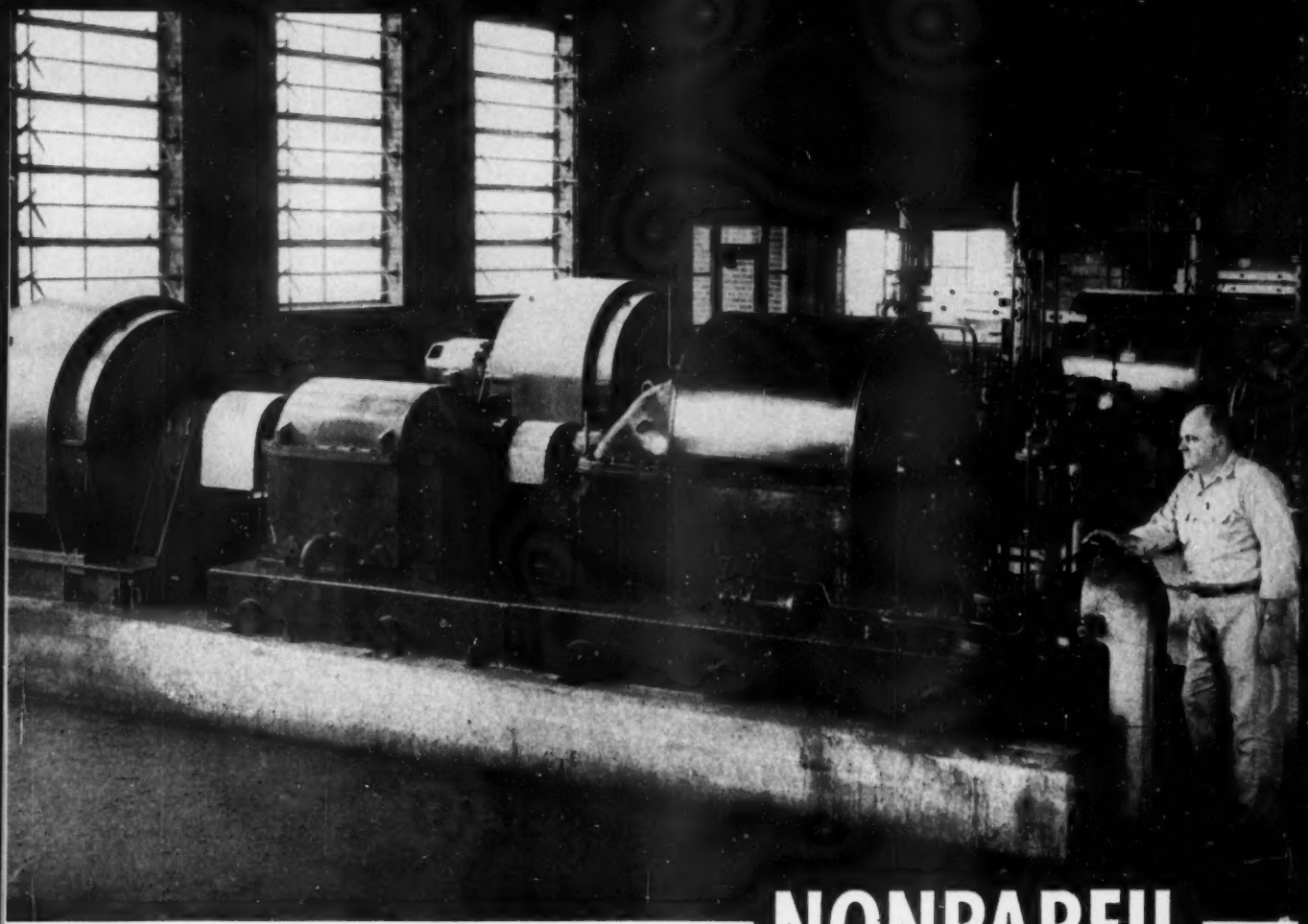
247 • New device provides a single, compact unit that acts as a dependable reducing-relief valve and as a filtering arrangement for line service. Line pressures up to 150 psi can be reduced and maintained at any regulated output from 0 to 35 psi without appreciable drift or air consumption. Easily accessible filter and dripwell assures clean air supply for pneumatically-operated instruments, etc.

Minneapolis-Honeywell Regulator Co, Industrial Div, Wayne & Windrim Aves, Philadelphia 44, Pa.

For more data on these items, use post cards p. 167. Identify your request with item number.

Industrial Crepe Paper

210 • New crepe paper has nearly three times the tensile strength of former industrial crepe paper and black varnished cambric, according to the manufacturer. It is made of kraft and manila fibers, can be wound on brazed coil lead or used as insulating tape on some types of transformer



NONPAREIL
TRADE MARK
Turbine Oil

Turbine oil systems stay clean with...

• When the two turbines shown above were installed in a large Milwaukee tannery, they were filled with NONPAREIL Turbine Oil. NONPAREIL lubricates each turbine and its reduction gear unit from one oil reservoir.

During nearly two years' operation, the original fills of NONPAREIL were not removed from the turbines either to clean the oil systems or to treat the oil. Neutralization numbers stayed below 0.04 mg. KOH/gm. Recently, plant officials and a representative of the turbine manufacturer made a thorough inspection of the turbines' lubricating systems. They found gears and bearings in excellent condition. They found no appreciable deposits either in the turbine oil or in the lubricating systems. The turbine manufacturer's representative expressed approval of the job being done by NONPAREIL Turbine Oil.

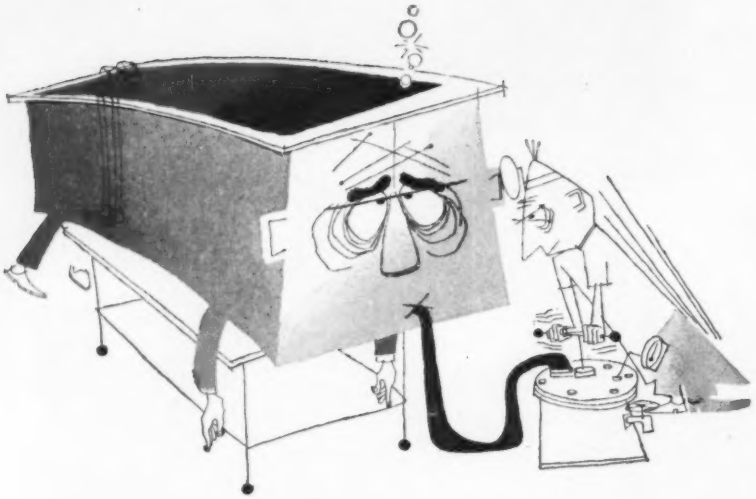
Through the use of NONPAREIL, officials of this Milwaukee tannery are assured of clean, trouble-free lubrication for the *life* of their turbines. This assurance is based on the written guarantee, given with each fill of NONPAREIL, that this outstanding lubricant will last for the *life* of the turbine it lubricates and that it will maintain a neutralization number below 0.15 mg. KOH/gm.

The Standard Oil lubrication specialist in your section of the Midwest will be glad to tell you about NONPAREIL's written guarantee. He will show you NONPAREIL operating records that cover up to 25 years' service in a single turbine. You can contact this lubrication specialist by phoning your local Standard Oil office. Or write, Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY

STANDARD

(Indiana)



has **coil-itis*** cramped your production flow?

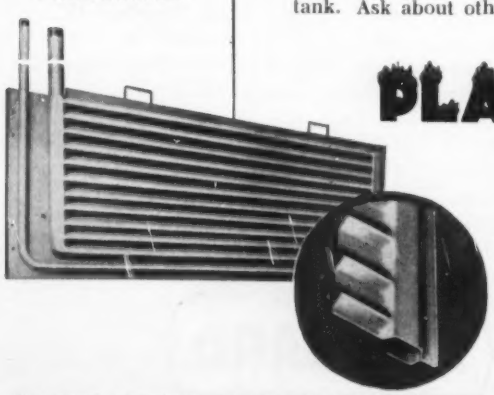
It's a waste of costly time to pump out the solution every time your process heating and cooling tanks get indigestion due to pipe coil troubles. You can save this cost and eliminate production bottlenecks by replacing the pipe coils with Platecoils. Platecoils can be removed and replaced **without dumping the solution.** They simplify maintenance and save hours of downtime. They heat or cool 50% faster and take 50% less space in the tank. As revolutionary as the new wonder drugs, Platecoils cure production troubles involving heat transfer . . . and give profits a shot in the arm.

Write for bulletin P79 today!

PLATECOILS SAVE 50% IN HEAT TRANSFER COSTS

PLATECOILS TRIPLE PRODUCTION

At Continental Motors Corp., 3 crankcase sections can be cleaned at one time when Platecoils are used while only one crank case can be cleaned with pipecoils in the tank. Ask about other case histories.



PLATECOIL

REPLACES PIPE COILS

*

Coil-itis — Diagnosed as tank heating and cooling problems. Platecoils — the prescription for solving pipe coil problems.

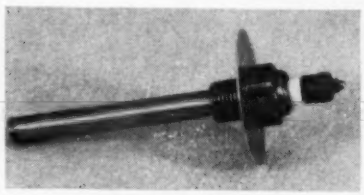
PLATECOIL DIVISION, KOLD-HOLD MANUFACTURING CO., LANSING 4, MICHIGAN

More EQUIPMENT NEWS

Begins on page 153

coils. Paper is claimed to be less expensive and easier to apply than varnished cambric.

A two-way stretch crepe for flexible cable insulation has also been developed. This is described as having excellent flexibility and electrical properties and is not subject to bursting during vacuum treating. **General Electric Co, Schenectady 5, N.Y.**



Midget Thermostat

206 • Heat-sensitive shell of redesigned midget thermoswitch has outside diameter of only ¼ in. Unit is adjusted and sealed at the factory to any temperature set-point between −50 and +450 F, has inherent sensitivity of 0.1 F. It is rated at one amp at 48-v ac or 32-v dc, has a hex head, 1¼-in. removable nameplate, ⅛-27 pipe thread and 1-29/32 in. long stainless steel shell (overall length is 3-5/32 in.). Inverse compression type available now; models with both regular and inverse contact arrangements will be available soon.
Fenwal Inc, Ashland, Mass.

For more data on these items, use post cards p. 167. Identify your request with item number.

Selenium Rectifier

228 • Unit is designed for installation at individual work stations. Each of two models currently in production, a 300-w and a 500-w unit, operates from a 115-v 60-cycle line. 90 to 135 v of filtered dc output may be varied in approximately equal steps by a 5-position tap switch. Output ripple is less than 5% at full load. Both units are rated for continuous duty at full load. Overload protection is built into the circuit. Unit can furnish dc power for magnetic chucks, small motors, testing switches, relays, controls, etc.
Rapid Electric Co, 2881 Middleton Rd, New York 61, N.Y.

Snap-Action Switches

213 • New series of snap-action switches is designed for actuating forces as low as ½ oz. Rigid lever integral actuators adapt to cam or straight-line motion. Units are particularly useful in low-force, cam-actuated applications on timing clock motors, instruments and meters, also in rotary switch assemblies, sequence switching gangs, limit switch applications.

Type W80 has a flat lever actuator designed for operation by straight-line motion or slow-moving cams. W82 switch has a hardened steel roller. W822 has a short roller lever actuator designed for fast cam

At left center is one end of fuel oil pipe line (approximately 1,000 ft. long), operating at about 100°F with FOAMGLAS pipe insulation. In foreground is part of 1,100 ft. steam line operating at about 400°F with FOAMGLAS pipe insulation. Note spray pond in background. *Insulation contractor: Thermal Products Company, Houston.*

ON THESE OIL AND STEAM LINES

FOAMGLAS

insulation spends most of its time under a shower but STAYS DRY

Keeping dry under a shower is a slick trick, but magic FOAMGLAS is the one insulation that can do it, day in and day out. That's one big reason why Dallas Power & Light Company chose FOAMGLAS to insulate oil and steam lines running right next to a spray pond handling concentrated alkaline water.

Chief Engineer R. D. Elliott points out, "The combination of water and chemicals really requires an extraordinary insulation, and we've found that neither moisture nor chemicals can penetrate the closed, inorganic cell structure of FOAMGLAS. That's why we count on it to combat corrosion and to maintain constant insulation efficiency."

PITTSBURGH CORNING CORPORATION
PITTSBURGH 22, PA.

PITTSBURGH PC CORNING

R. D. Elliott

Pittsburgh Corning Corporation, Dept. AA-23
Pittsburgh 22, Pa.

Please send me free sample and booklets on use o FOAMGLAS for:

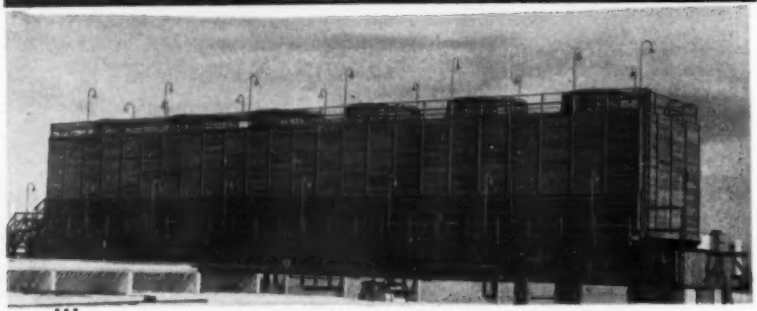
☐ Piping and process equipment ☐ Refrigerated Structure
☐ Normal Temperature Buildings
☐ Advise nearest source of supply
☐ Send engineer to discuss specific problem

NAME _____ TITLE

COMPANY _____

CITY _____ ZONE STATE

UNITED Builds Dependable Towers
for All Water Cooling Purposes



United tower in oil refinery service

Mechanical Draft Towers featuring low pressure, closed system water distribution, redwood interiors and effective counterflow cooling over large deck surfaces.

Atmospheric Deck Type Towers of redwood throughout, with closed low pressure distribution through sprinklers or spray nozzles.

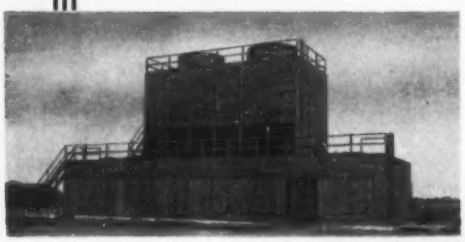
"Package" Type Towers of steel or wood, mechanical or natural draft, in 3 to 15 tons capacity.

Bulletin No. 50 gives full details. Yours upon request.

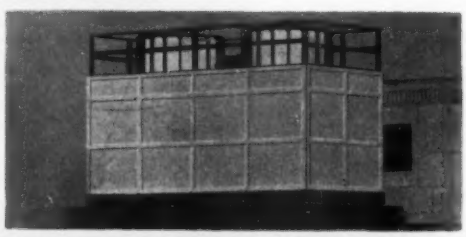
UNITED COOLING TOWER CO.

4022 Broadway, Kansas City 2, Mo. Plant: Pilot Point, Texas

Authorized Representatives in Principal Cities



United compressor plant installation



United air conditioning tower, large public bldg.

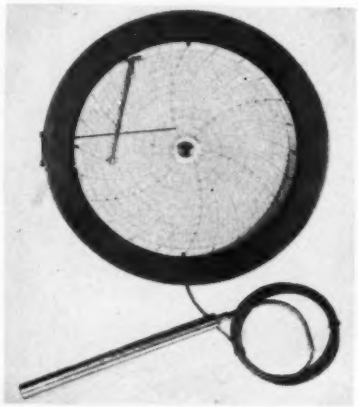
UNITED COOLING TOWERS

More EQUIPMENT NEWS

Begins on page 158

actuation or for applications where compactness and maximum resistance to vibration are required. Solder lug or screw terminals available. Switches are listed by UL for 15 amp, 125, 250 or 460-v, ac; ½ amp, 125-v, dc; ¼ amp, 250-v, dc.

Micro Div, Minneapolis-Honeywell Regulator Co, Freeport, Ill.



Recording Thermometer

248 • For plants using sub-zero temperatures for shrink fitting, stabilization and stress equalization of alloys, low temperature equipment testing, etc, model NR 12-in. recording thermometer keeps accurate time-temperature records from −200 to +200 F in its 8 different scale ranges. Companion dial indicating thermometer, model PD, substitutes pointer for pen and clean, easy-to-read dial for chart. Dial thermometer comes in 6- and 8-in. diameter sizes.

Dickson Co, 7420 S Woodlawn Ave, Chicago 19, Ill.

For more data on these items, use post cards, p. 167. Identify your request with item number.

Plastic Floor Compound

212 • *Swift-floor* plastic floor resurfacing compound has new cohesive agent to produce a harder yet more resilient floor surface. Irregularly shaped crystals of *Cryptolite* pack together to form a hard, non-skid surface that can be used one minute after application, manufacturer clams. To apply, simply prime old floor surface, fill with compound, and tamp or roll. Can be applied over wood, concrete, brick or steel, indoors or out.

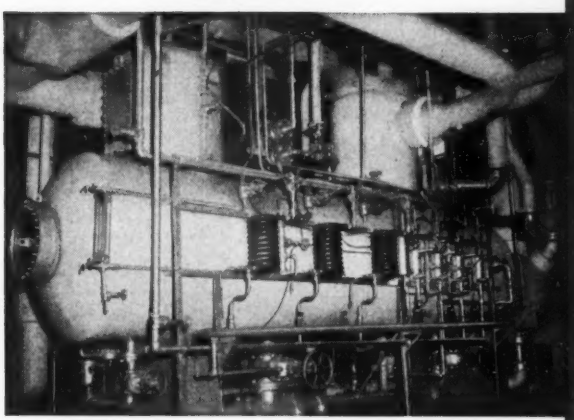
The Monroe Co, Inc, 10703 Quebec Ave, Cleveland 6, Ohio.

PLANT PA SYSTEM

249 • *Femco Trolleyphone*, plug-in model, 2550 series, is a common communication system. Each station is equipped with a press-to-talk microphone and a speaker with automatic volume control. Words spoken with any microphone come out of all speakers at a natural voice level re-

Do you need proved power plant equipment? — let this ALCO check list help you

1 Closed Type Feedwater Heaters
2 Evaporator Condensers
3 Condensate Coolers
4 Jacket Water Coolers
5 Lubricating Oil Coolers
6 Evaporators
7 Oil Tank Suction Heaters
8 Fuel Oil Heaters
9 Blowdown Exchangers
10 Aircooled Heat Exchangers
11 Prefabricated Pipe
12 Propane Storage Tanks
13 Large Diameter Water Lines
14 Penstocks



For Example—ALCO Flex-Tube Evaporators have a positive-acting, thermomechanical descaling action.

Making use of this principle, engineers designed a patented arrangement of struts, tension bars and split support plates. The tubes bend or flex when heat is applied to the coil side. When cold water is sprayed over the tube bundle, the tubes contract, and scale cracks off and is flushed away through blowdown openings.

Other important features include:

HEATING ELEMENT SITUATED IN LOWER HALF OF SHELL, provides maximum disengaging area.

SHELL SIZE GIVES AMPLE SPACE under heating element for scale removal.

SMALL SEPARATE REMOVABLE CHANNEL AND COVER eases job of maintenance men.

TWO OR MORE BLOWDOWN CONNECTIONS of large diameter for effective flushing.

UNIFORM COMPRESSION BOLTING assures tight joints but permits quick convenient access to key points for inspection and maintenance.

For more details about ALCO Flex-Tube Evaporators or your other power plant equipment needs, mail the coupon or call the nearest ALCO sales engineer at Beaumont, Chicago, Dunkirk, Houston, Kansas City, Los Angeles, New York or Tulsa.

ALCO

ALCO PRODUCTS DIVISION
AMERICAN LOCOMOTIVE COMPANY
Dunkirk, N. Y.

***In step with tomorrow*—Alco Aircoolers, Heat Exchangers, Evaporators, Feedwater Heaters, Pressure Vessels, Pipe**

ALCO PRODUCTS DIVISION
American Locomotive Company
Schenectady, New York

P

Gentlemen:

Please send me the ALCO Products Catalog AL-3-T. We are interested in ..... equipment.

Name_____ Position_____

Company_____

Address_____

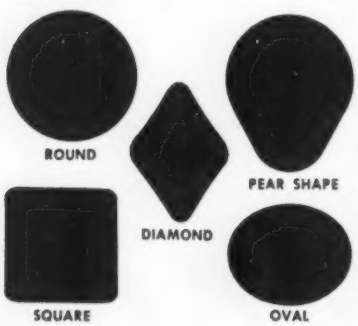
City_____ Zone_____ State_____

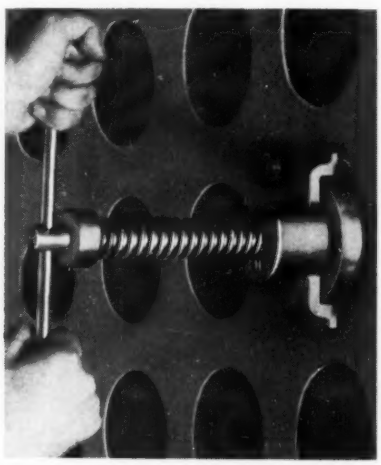
ROTO *Hand Hole* Seat Scraper

Eliminates Dirty, Tedious Work

Here is a simple, hand-operated tool for cleaning inside caps on boilers that will pay for itself many times over. This tool is equipped with retractable knives mounted on a revolving spindle having a bearing within a substantial yoke. An adjustable spring automatically maintains tension on the knives, sufficient to remove all foreign matter but not enough to cut the metal. A few turns to the right, and the job is done. A half turn to the left releases the tool. Try a Roto Seat Scraper and you'll wonder how you ever got along without one.

These are some of the hand hole shapes cleaned with a Roto Seat Scraper. Various sizes available.





Illustrating ease of operation of Roto Hand-hole Seat Scraper.

Roto Hand-hole Seat Scraper for B & W Boiler.

What Users Say—

It did a fine job. Completed the work in 80% less time.
(Engineer, Chemical Plant)

Roto Seat Scraper has paid for itself many times over on our Keeler Boiler.
(Supt., Public Utility)

One man cleaned inside cap seats on boiler header in 4 hours. Formerly took 2 men 3 days.
(Pennsylvania Manufacturer)

We also make a Reseating Machine for cleaning outside caps to assure a smooth, true fit. Send for details.

SEND FOR BULLETIN

ELLIOTT COMPANY-ROTO DIVISION
153 SUSSEX AVENUE **NEWARK 1, N. J.**

More EQUIPMENT NEWS

Begins on page 158

gardless of distance. Equipment consists of transreceiver units that incorporate both transmitters and receivers, speakers and microphones.

Power is taken from existing trolley wire or power line, either 250- or 550-v dc. Current drain is about 0.5 amp. Installation can also be made for 110 or 220 v ac single or 3-phase, or from 6- to 40-v batteries.

Farmers Engineering and Mfg. Co, 549 Brushton Ave, Pittsburgh 21, Pa.

Flow Meter

219 • New *Flo-Watch* model AFUAQ meters flow of liquids, steam, air and gas. Unit measures flow through standard differential producers like Venturi tubes, nozzles, orifices, can also be used with Kennison open nozzles, flumes, weirs. Instrument is adaptable for any combination of totalizing, indicating or recording functions.

Totalizing model with transmitter attachment can actuate a secondary instrument or pace a chemical feeder remotely located. Functions of the secondary unit will be in direct proportion to flow. Totalizer reads directly in gallons, cubic feet, etc, indicator provides maximum readability from 25 to 100% of full scale. Bulletin 300-J14.

Builders-Providence, Inc, 345 Harris Ave, Providence, R. I.

For more data on these items, use post cards, p. 167. Identify your request with item number.

Universal Air Vent

218 • Radiator valve will vent water or steam systems automatically. Valve can be cleaned of leak-sealing compounds or minerals without draining water system. Hygroscopic fibre discs open to allow air to vent, close against steam or water. Selector screw controls rate of venting. Operates at maximum steam pressure of 15 psi, maximum water pressure of 50 psi.

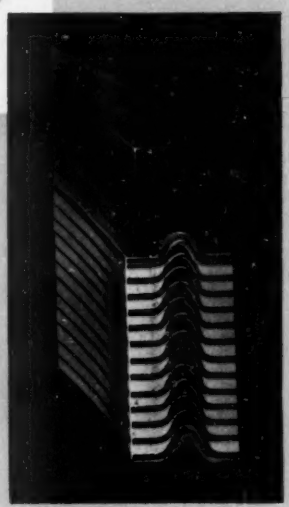
Hoffman Specialty Mfg Corp, 1001 York St, Indianapolis 7, Ind.

Miniature Pressure Transducer

226 • Type 4-310 *Star* pickup measures only ½ in. in diameter and less than ¾ in. in length. Flush diaphragm is designed for insertion directly into a process vessel or stream of either liquid or gas for test and monitoring purposes.

The pickup emits a known signal for a given pressure change. As the pressure

ANKOTALLIC SPIRAL WOUND GASKETS



Withstand even the most severe service conditions for an entire range of pressures.

BRANCHES

BALTIMORE, MD.
BOSTON, MASS.
BUFFALO, N. Y.
CINCINNATI, OHIO
CHICAGO, ILL.
CLEVELAND, OHIO
DAYTON, OHIO
DETROIT, MICH.
HOUSTON, TEX.
INDIANAPOLIS, IND.
LOS ANGELES, CAL.
MILWAUKEE, WIS.
MONTREAL, CANADA
NEW ORLEANS, LA.
NEW YORK, N. Y.
PHILADELPHIA, PA.
PITTSBURGH, PA.
SAN FRANCISCO, CAL.
SEATTLE, WASH.
SPOKANE, WASH.
ST. LOUIS, MO.
TOLEDO, OHIO
WILMINGTON, CAL.

Ankotallic Spiral Wound Gaskets are made of one continuous strip of preformed metal. They are wound spirally from the inside to the outside with a cushion of filler between each metal ply. In this way it is possible to increase or decrease the number of metal and filler plies, and enable the gasket to survive under severe service conditions and a range of pressures.

It is the preformed U-shaped groove in the metal that provides the safe interlocking feature and creates a type of artificial "lung" that reacts to the existing conditions, be they mechanical compression, temperature changes, or internal pressure variations.

Ankotallic was designed on a principal that has been tried and proved. In no other type of gasket is it possible to vary the compressibility to meet requirements of a pre-designed joint with bolt loading limits already established.

In addition to being able to increase or decrease the number of plies in a given flange area, compressibility of Ankotallic Gaskets is further regulated by taking into consideration the hardness and resiliency of the type of metal specified for the particular service condition.

Various styles of Ankotallic Spiral Wound Gaskets are carried in stock for use on boiler manholes, tube caps, waterwalls, economizers and many other boiler accessories.

THE ANCHOR PACKING COMPANY

GENERAL OFFICES: PHILADELPHIA, PA.
FACTORIES: MANHEIM, PA. ELKHART, IND. MONTREAL, CAN.

FIBROUS AND METALLIC PACKINGS FOR EVERY INDUSTRIAL PURPOSE

DARTS FIT TIGHT, STAY TIGHT because spherical grinding finishes the seats to a true ball joint with wide, true-bearing surfaces. Darts are easily made tight without jamming. They can be used on installation after installation without scarring the seats.

QUICK FACTS

- **TWO BRONZE SEATS** of special alloy offer extra resistance to pitting and corrosion. They provide years of leakproof protection.
- **PRACTICALLY INDESTRUCTIBLE** Dart bodies and nuts consist of top-quality, air-refined malleable iron for extra resistance to stress and stretching.
- **TOUGH, HEAVY SHOULDERS** can take the most severe wrenching without damage.

These features make Darts your best union buy...they assure trouble-free performance year after year.

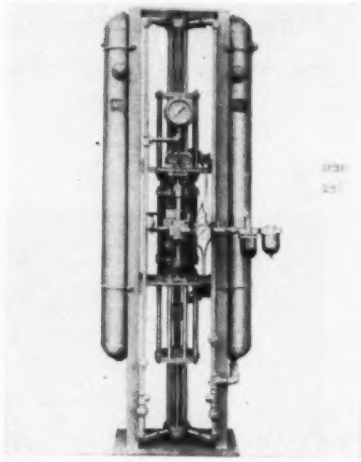
DART UNION COMPANY
Providence 5, Rhode Island
The Fairbanks Co. — Distributors
Boston•New York•Pittsburgh•Rome, Ga.

DART

More EQUIPMENT NEWS

Begins on page 158

changes against the surface or in the pipe or vessel where the pickup is installed, output voltage changes in proportion. Calibrating applied voltages allows exact interpretation of output in terms of pressure. Response is accurate to frequencies as high as several thousand cycles per second, so unit is applicable to studies of high-speed pumps and compressors where mechanical pressure instruments would have insufficient response speed. Bulletin CEC 1534. **Consolidated Engineering Corp, 300 N Sierra Madre Villa, Pasadena 8, Calif.**



Air-Hydraulic Pumps

250 • Heavy-duty pumps and power units develop high fluid pressure from low air pressure. Suitable for operating high pressure cylinders, clamps, valves, actuators, hydraulic presses; for high pressure testing; for long pressure-holding cycles, etc. Built as package units, they are available in vertical or horizontal construction. Both pressure and volume are adjustable. **Ledeen Mfg Co, 1600 San Pedro St, Los Angeles 15, Calif.**

For more data on these items, use post cards p. 167. Identify your request with item number.

Snow Detector

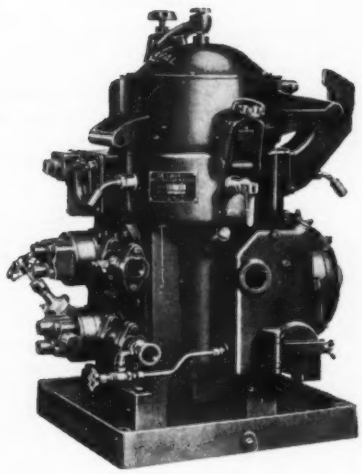
202 • Weather sensing equipment is useful for operating snow removal systems automatically. Unit detects precipitation when ambient temperature drops below 37 F, turns on heating elements when icing conditions exist. Up to 30 amps at 117-v ac can be switched without external relays. **Motorola, Inc, 4545 W Augusta Blvd, Chicago 51, Ill.**

Plug-In Alarm System

237 • *Panalarm* 50 plug-in annunciator system incorporates complete interchangeability of circuits and functions. A single standard unit can be used to signal any "off-normal" condition throughout a plant. Plug-in units are hermetically sealed, thus protected from adverse atmospheres or cor-

NO GETTING AROUND IT!

[redacted]



The cost of a De Laval Oil Purifier is only a fraction of the cost of the turbine or engine that it protects. The comparatively modest investment represented by a De Laval centrifuge is far outweighed by the cost of even ***one*** serious shutdown. A De Laval is, in truth, inexpensive insurance.

A De Laval Purifier, by means of centrifugal force applied in the most efficient manner, removes from the oil all water, dirt or sludge. It keeps the lubricant both ***clean*** and ***dry***. Purification is complete—an important point—for water can be as serious a source of contamination as dirt.

A De Laval Oil Purifier thus provides assurance that there will never be turbine trouble due to impure lubricating oil. The protection it gives in this respect is ***absolute***.

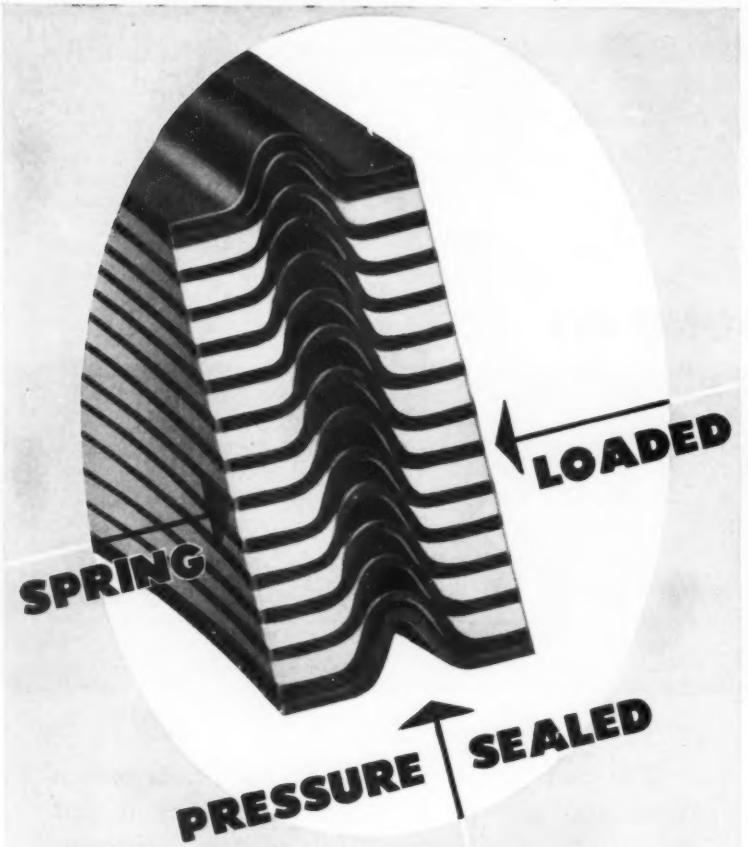
THE DE LAVAL SEPARATOR COMPANY
Poughkeepsie, New York 427 Randolph St., Chicago 6

•

DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

[redacted]

FOR MORE DEPENDABLE POWER PRODUCTION



It's the live-spring action and U-shape of the metal plies in Ajax Spiralwound Gaskets that permits them to give and take with varying pipe line or boiler stresses, to seal joints tight at safe bolt loads and utilize the pressures they are sealing against to keep them tight under all operating conditions.

There are types and sizes for all standard flanges and for manholes, handholes and tube caps for all makes of stationary and marine boilers, waterwalls, economizers, etc.

Materials of construction include plated low carbon steel or stainless, Canadian or blue African asbestos or chemically inert duPont Teflon.

Sold universally through industrial distributors. Ask your supply house or write—

UNITED STATES GASKET COMPANY

FABRICATORS OF "TEFLON" & "KEL-F" FOR THE CHEMICAL PROCESS & ELECTRONIC INDUSTRIES

CAMDEN 1 NEW JERSEY

Representatives in Principal Cities Throughout the World

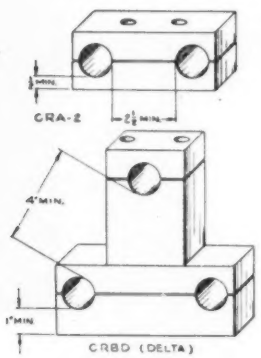
More EQUIPMENT NEWS

Begins on page 158

rosion and suitable for all Class 1, Division 2 locations.

Used as either running or trouble signals, the systems provide both an audible and a visual alert signal that must be acknowledged by the operator when any "off-normal" condition develops. Visual signals are provided by either torpedo bullseye lamps or backlighted, illuminated nameplates. Catalog 100.

Panalarm Products, Inc, 6312 N Broadway, Chicago 40, Ill.



Cable Racks

251 • Phenolic insulating cable racks are divided into two groups: 300 v and under, or over 300 v. Standard racks have maximum size holes possible to maintain required clearances. Mounting bolt holes take standard size bolts.

Adalet Mfg Co, 14300 Lorain Ave, Cleveland 11, Ohio.

For more data on these items, use post cards, p. 167. Identify your request with item number.

Oil Mist Control

216 • *Precipitron* oil mist control unit will recover coolant oil from mist and smoke generated by high speed cutting, grinding, milling, etc. Available in two models: type PO-6 with air-handling capacity of 600 cfm, and type PO-12 with capacity of 1200 cfm. Unit is completely self-contained, shipped factory-assembled and tested. PO-6 is 55-in. high, 22-in. wide, 24-in. deep, weighs 265 lb.

Westinghouse Sturtevant Div, Dept T-509, 200 Readville St, Hyde Park, Boston 36, Mass.

Electric Solenoid Valves

252 • Improved Atkomatic solenoid valves are available for pressures to 3000 psi. Adjustable timing on closing stroke is available to 300 psi. This eliminates shock on supply lines, particularly on hydraulic operations. Valves are packless, easily maintained, and designed to handle hydraulic operations, oil, water, steam, air, gases or any media not harmful to bronze.

Atkomatic Valve Co, 545 W Abbott St, Indianapolis, Ind.

(Advertisement)

HALL INDUSTRIAL WATER REPORT

Hall Laboratories, Inc.—A Subsidiary of Hagan Corporation, Pittsburgh, Pa.

Volume 1 | FEBRUARY 1953 | Number 1

New Water Manual Published by ASTM

Of interest to everyone concerned with industrial water is ASTM's "Manual of Industrial Water," a January 1953 release, prepared by Committee D-19. Manual discusses uses of industrial water, difficulties caused by industrial water, compositions of waters and deposits, treatment, sampling, analysis of water, identification of water-formed deposits.

Research by Hatch Gives New Basic Facts on Threshold Treatment for Corrosion Control

Research papers by Dr. G. B. Hatch of Calgon, Inc., titled "Protective Film Formation with Phosphate Glasses" and "Inhibition of Galvanic Attack of Steel with Phosphate Glasses" provide a better scientific understanding of the mechanism of film formation with Calgon.

Data prove Calgon stops corrosion by virtually eliminating flow of current between anode and cathode in corrosion cells.

Research shows Calgon is a cathodic inhibitor. All cathodic inhibitors are "safe" inhibitors, because they do not increase tendency foward pitting.

Data reveal that protective film is formed by electrodeposition process, and that Threshold Treatment for corrosion is quite different from Threshold Treatment for scale prevention.

Write if you want a free copy of these fundamental papers.

Industrial Water Statistics

According to U. S. Dept. of Commerce statistics, use of industrial water for process has been estimated at 80 billion gal per day during 1950. This is 8 times the quantity required in 1900, although population increase in same 50 years was only 2-fold.

Manufacture of steel, production of electric power require 50 billion gallons of the 80 billion per day. Industrial use of water is estimated to increase 170 per cent from 1950 to 1975, according to Materials Policy Commission.

Pilot Plant Designed for Steel Company Results in Minimum Cost for Waste Disposal

A Pennsylvania steel company had to dispose of wash waters evolved in the manufacture of producer gas.

This wash water contained objectionable quantities of phenol, sulfide, and cyanide.

Preliminary study showed that either chemical treatment, or closing up wash water system could do the job. A Hall Labs staff engineer recommended use of a pilot plant to determine chemical treatment costs. He specified equipment for pilot unit, and provided detailed instructions for operation. Pilot plant showed that all hydrogen sulfide and cyanide and about 90% of phenol could be removed.

But cost analysis of chemical treatment revealed it was 2 or 3 times as costly as closing up system. On this basis, decision was to install a recirculating system for the producer gas wash water.

Major problem in closed system was build-up of suspended solids. Methods of controlling this were studied by the Hall staff, and recommendations made to steel company.

State antipollution requirements were satisfied, and another step taken toward clean natural streams with the minimum cost to industry.

Field Reports on Industrial Water Treatment

Herman Reda, Service Engineer in our Detroit Office, made the following report on a food processing plant in his area:

"*Turbines have now operated continuously for 3½ years. Prior to use of Hall System, plant had to clean units every 6 months.*"

A report on boiler water control comes from Bill Pfeiffer of the St. Louis Office. Report concerns a paper company:

"*Client is pleased with silica treatment. After silica had been fed for about 3 months, boilers were opened for inspection, found to be much cleaner than client ever saw before. Heavy sludge usually found in top rear drum and mud drum was almost gone. Silica is also helping out at the filters, and filtered water contains no suspended matter. Client cleaned filters with Buromin—pleased with results.*"

"Calgon" and "Buromin" are names of phosphate glasses developed by Hall Laboratories for industrial water treatment and marketed, respectively, by its associates, Calgon, Inc., and the Buromin Company who have registered the names in the U.S. Patent Office as trademarks. "Hall System" is similarly registered as a service mark by Hall Laboratories.

Industrial Water Problems Require Special Handling

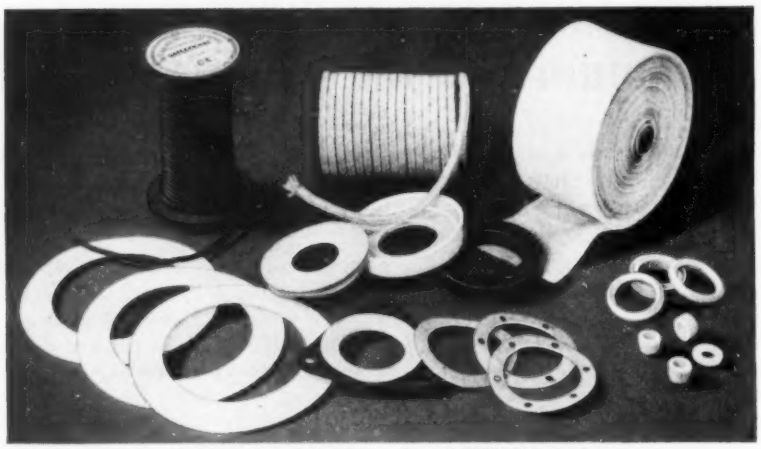
There are no "stock answers" to industrial water problems. For information, write, wire or call Hall Laboratories, Inc., P.O. Box 1346, Pittsburgh 30, Pennsylvania.

Water is your industry's most important raw material. Don't waste it.

When it comes to

Teflon* PACKINGS and GASKETS

come to Garlock...manufacturers of mechanical packings since 1887



Above—A few of the wide variety of TEFLON packings and gaskets manufactured in the Garlock factories.

GARLOCK pioneered in the design and manufacture of packings and gaskets made of TEFLON. Garlock products made of TEFLON are unaffected by acids, organic solvents and other chemicals at operating temperatures from below −90°F. up to 500°F. These packings and gaskets are ideally suited for many other applications due to TEFLON's low coefficient of friction.

We have the facilities to mold, machine, or form TEFLON in a wide variety of shapes and sizes for packing and gasketing. When you need finished TEFLON parts contact your Garlock representative or write for our TEFLON Catalog.

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK
In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.

*The DuPont Company's Trademark

GARLOCK

PACKINGS, GASKETS, OIL SEALS,
MECHANICAL SEALS,
RUBBER EXPANSION JOINTS

VERTICAL-PUMP INTAKE

Continued from page 91

have enough length to straighten flow. Pumps run well in any combination.

Existing Jobs. Mutual interference between two pumps, Fig. 5, gave trouble. Flow was extremely unstable, with a strong but wandering vortex under each pump. Flow to second pump was erratic.

Three solutions were tried in the model. We (1) simulated ideal channels with baffles at each pump (2) lowered pumps (3) combined solutions 1 and 2.

Solution 1 made pumps independent of each other, suppressed most of the erratic flow. But minor disturbances still tended to form. Pumps were lowered to 0.45 bell diameter without using baffles. This was more effective; minor disturbances still prevailing were negligible. Solution 3 eliminated all disturbances at pumps.

This design could easily be used for a new installation but, since it required much work in the existing channel, we decided only to reduce pump clearance.

To find how much of the floor must be close to the bell to obtain Solution 2 results, Lucite blocks were placed underneath the pumps. Trial showed block with side equal to two bell diameters was enough. Duplicated in the prototype with concrete, all vibration was eliminated.

Fig. 6 shows another existing installation having excessive vibration. Model showed inlet jetting between pumps created a number of vortices on each side. Fig. 7 is final design of the cells.

Three corrective steps were used. We erected a dam of suitable proportions between pumps and inlet, three-fourths a bell diameter from center of pumps. Suction bells were lowered to a clearance of 0.4 bell diameter. Flow at *A* was good, but at *B* there was a minor vortex under bell because inlet pipe was at an angle. Final correction was insertion of another wall between dam and back wall separating pumps. Its thickness was such that cells were symmetrical, Fig. 7.

Intake-Channel Design. Water can be brought upward in an axial manner or horizontally and from above, and distributed evenly around area between bell and floor. Latter method needs less depth and material so we'll look it over now. Simple installations can be evaluated with past test results.

Suction-bell diameter *G*, Fig. 8, is used for reference in design and is about twice impeller-eye diameter. Different ratio modifies design values given below.

Bell clearance from floor is perhaps most important. Value of *G*/4 has same flow area as bell cross section and is

NOW

YOUR OPERATORS NEED NOT BE EXPOSED

To the dangers of High Voltage!

High Interrupting Capacity Fuses Can Now Be Handled Without Exposure To High Voltage, Without a Hookstick!

THE NEW "SA-FUSE" CONTROL

Fuses are *Dead* and *Grounded*

Operator is Shielded From Live High Voltage Parts When Fuse Compartment is Opened.

THE OLD . . . STANDARD CONTROL. Fuses are Live and operator is Exposed to High Voltage When Fuse Compartment is Opened. Hook-Stick Always Needed.

The fuses in the "Hi-Fuse", High-Voltage, High-Interrupting Capacity Motor Control above are being handled with the following safety assurances: (1) *that the fuses are completely disconnected from the circuit,* (2) *that the fuses are grounded,* (3) *and that a heavy insulating barrier shields the operator from high voltage.*

These new important safety features are now provided by the new SA-FUSE compartment for Hi-Fuse Control. When the fuse door is opened, a gang-disconnect separates the fuse panel from the high voltage circuit and brings the fuses up in safe, convenient reach. The fuses can then be quickly inspected or replaced.

Hi-Fuse Control with the SA-FUSE Compartment is an economical, highly protective control. It is the kind of modern motor control you will want in your plant because it is a forward step in providing security from high voltage hazards. The E-M Sales Engineer near you will be glad to give you complete information.

Be sure to write for E-M Bulletin No. 211 and E-M Foto-Facts No. 21, which show step-by-step illustrations of SA-FUSE operation.

3300-TPA-2133

ELECTRIC MACHINERY MFG. COMPANY
MINNEAPOLIS 13, MINNESOTA

E-M

• THE HILCO OIL RECLAIMER
• REMOVES WATER, SLUDGE, ACIDS
• IT IS CONTINUOUS AND AUTOMATIC

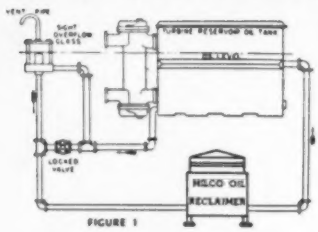


FIGURE 1

• The HILCO OIL RECLAIMER is self-contained, including built-in pumps, electric heaters, starters and controls. It is compact, easy, and quick to service.

• The HILCO system results in removing contamination as fast as it is formed, thus maintaining the oil in first class condition.

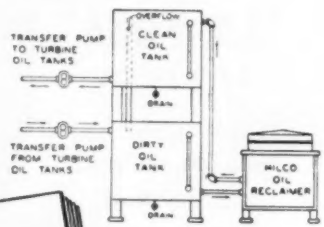


FIGURE 2

FOR MORE INFORMATION ON THE HILCO SYSTEM

VERTICAL-PUMP INTAKE

Continued from page 192

minimum to which bell can be dropped and still retain accelerating flow. Best range is $G/2$ to $G/3$. Use it wherever possible.

Back Wall. When flow approaches from one direction a wall behind pump is beneficial. Vortices do not form in idle water behind pump. Locate wall $3G/4$ from pump center.

Channel Width. For a single pump exact width isn't important if it equals or exceeds $2G$ and pump is in center. Since space is usually at a premium and large channels tend to induce secondary currents, don't exceed a value of $2G$.

Minimum Length. Channel should produce even water distribution just ahead of pump. For reference, a plane $3G/4$ from pump center, and in front of it, can be used. Flow through plane should be normal to it without irregularities. Channel length of $2\frac{1}{2}$ to 3 times width upstream from plane usually eliminates disturbances. This makes over-all length about $7G$.

With strongly distorted flow at inlet, use vertical partitions at the $2\frac{1}{2}$ to 3 ratio. In extreme cases a sloping ceiling over channel with back edge 1 1/3 (G) from floor may be needed, Fig. 4. Pump isolation is completed by using a wall at back edge of tunnel.

Pumps in Series. Avoid putting a number of pumps in one long channel, if possible. Danger here is mutual interference. But if long channel is used keep velocity at same value as in a single-pump installation. Eliminate turbulence in flow as it passes from one pump to next.

Have channel width at each pump equal to at least $W/G = 1 + (4G + 8GN)/3H$, where W = channel width, G = suction-bell dia, H = water depth, N = number of pumps downstream.

Have spacing between pumps enough to stabilize and redistribute flow as it passes any pump. Distance of $2\frac{1}{2}$ to 3 times channel width between reference planes is probably adequate. But always check a proposed installation with a model.

Pumps in Parallel. An installation with pumps side by side in a large bay can be considered made up of a number of single cells. Whether walls are needed between pumps depends on entrance conditions. Check with a model.

Field experience proves the value of model testing. Bad effects of a poor installation may be overcome by rigidly bracing pumps and using oversize bearings and shafts. But this ignores basic trouble and only prolongs the interval between repairs.

FREE..to valve users and buyers

MAIL THIS COUPON TO...

THE OHIO INJECTOR COMPANY
114 MAIN STREET
WADSWORTH, OHIO

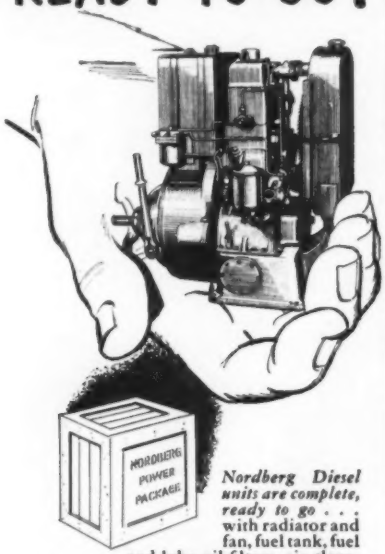
Please send me a copy of the new booklet, "OIC Catalog Digest for Quick Valve Selection".

Name_____ Title_____

Company_____

Address_____

Here's your
COMPLETE, COMPACT
NORDBERG
Diesel Engine . . .
READY TO GO!



Nordberg Diesel units are complete, ready to go . . . with radiator and fan, fuel tank, fuel and lube oil filters, air cleaner, and starting system. Fill the radiator, crankcase and fuel tank and you're producing reliable, low cost power . . . for power units on shovels, for crane magnets, for pumps in mines, quarries, and irrigation, for petroleum production pumping, for auxiliary generator sets ashore and afloat, for standby lighting units in manufacturing plants—and for hundreds of other power jobs.

Built in 1, 2, and 3-cylinder sizes from 10 to 45 hp, these heavy duty medium speed units are available as straight power units with stub shaft or clutch power takeoff—as generator sets producing from 6 to 30 K.W.—and as "packaged" centrifugal pumping units.

Send the coupon today for more details.

NORDBERG MFG. CO., Milwaukee, Wis.

NORDBERG
BUILDERS OF AMERICA'S LARGEST LINE OF HEAVY DUTY DIESELS

MAIL THIS COUPON TODAY

Nordberg Mfg. Co., Milwaukee, Wisconsin

Send catalog covering Nordberg Type 4FS Diesels. I am interested in a unit for the following service:

_____

Your Name_____

Company Name_____

Address_____

City_____ Zone____ State_____

4-353

MARMADUKE

Continued from page 146

wanted him below, word quickly spread that something unusual was up. So the fireroom fiddley soon lined with off-watch firemen. Another delegation, made up of engineers, oilers and water tenders followed Marmy into the fireroom.

"Now look here, Surfaceblow," demanded the Chief in his most sarcastic manner, "will you kindly explain why the bloody hell you put that anvil into the furnace? And mark you well," threatened the Chief, "unless you have a reasonable answer, which you naturally do not, I'll log you two days' pay."

Marmaduke scratched his head and stared at the smoking, red-hot anvil on the floorplates. He seemed greatly puzzled by all the commotion. Everyone ganged around, waiting to hear his explanation. Matt Feeley had a belligerent grin on his pan and stared hard at Marmaduke. It was easy to see that this was going to be sweet revenge for Matt.

"That's a horse on me," finally exclaimed Marmaduke in his foghorn voice, scratching his head again. "*That anvil musta been in the coal. I guess I heaved it into the furnace without NOTICING it.*"

That sent a roar of laughter through the fireroom. Most of the crew couldn't lift that anvil, let alone *heave* it.

The Chief didn't think that explanation funny. His face grew purple and he started sputtering, "In amongst the coal, IN A PIG'S NECK," he bellowed. But just as he was about to split a seam he evidently got a bright idea.

"All right, Mr. Smartalec," he beamed. "If you say it was in the coal—it was in the coal. But it took three of us to get it out of there. So let's see YOU heave it in with the shovel."

This was really more than anyone bargained for. Marmaduke was on the spot—and for sure. Stokers, oilers and engineers closed in closer around Marmaduke to see what he'd do. But Marmy was undaunted. He grabbed a shovel and slid it under the anvil. Then he opened the same high furnace door the anvil came out of. He braced his legs and made one mighty heave. The anvil went flying into the furnace. But it didn't stop on the coal bed. It kept right on going over the bridge wall in back of the long, corrugated furnace and landed on the combustion chamber floor, with a helluva crash. For a second it seemed like that blow cracked the combustion chamber's bottom. Everyone stood frozen stiff as a statue, as if waiting for the explosion to send the ship to kingdom come. Nothing happened.

Without saying a word, Marmaduke threw his shovel into the coal bunker

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300 LB.
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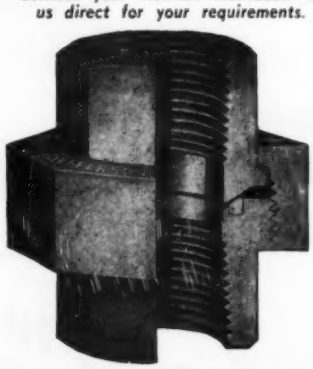
The name "Jefferson" means high quality . . . the kind you can be certain will give you long, care-free service year after year. And if you use Jefferson 300 lb. Unions, you can tackle those tough jobs with absolute assurance your piping jobs will be RIGHT and STAY RIGHT. Remember these facts: Jefferson Unions are made of malleable iron having a tensile strength of 55,000 p.s.i.; are air tested before shipment; have octagonal ends for any type wrench; OWG 2000# to 2" and 1000# up to 4".

The Jefferson line includes AAR male and female unions, Enduro 300#, Excel 250# and Master 150# unions. All iron seats are also available in all types.

Contact your nearest distributor or us direct for your requirements.



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GAS ENGINES

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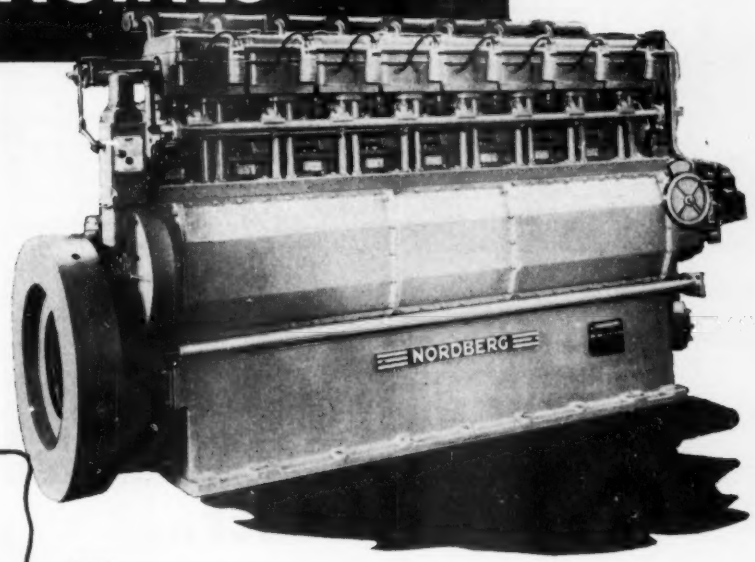

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1. *High thermal efficiency.*
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NORDBERG 4-cycle spark-fired gas engines, in sizes from 265 to 4260 H. P., now fill a long desired need for a highly efficient prime mover in industrial and municipal service. Increasing gas fuel costs have made *economy* the "watchword" of power plant operation. Nordberg *SUPAIRTHERMAL* spark-fired gas engines have a thermal efficiency in excess of 40 per cent as compared to 30 per cent or less in conventional non-supercharged engines.

Substantial savings in fuel costs and lower installation costs result through use of Nordberg gas engines. When capitalized over a period of years, they will more than pay for the original investment.

If you are looking for ways to cut power costs, get the full story on this latest Nordberg achievement . . . the result of sixty years' experience in the design and construction of prime movers and heavy machinery.

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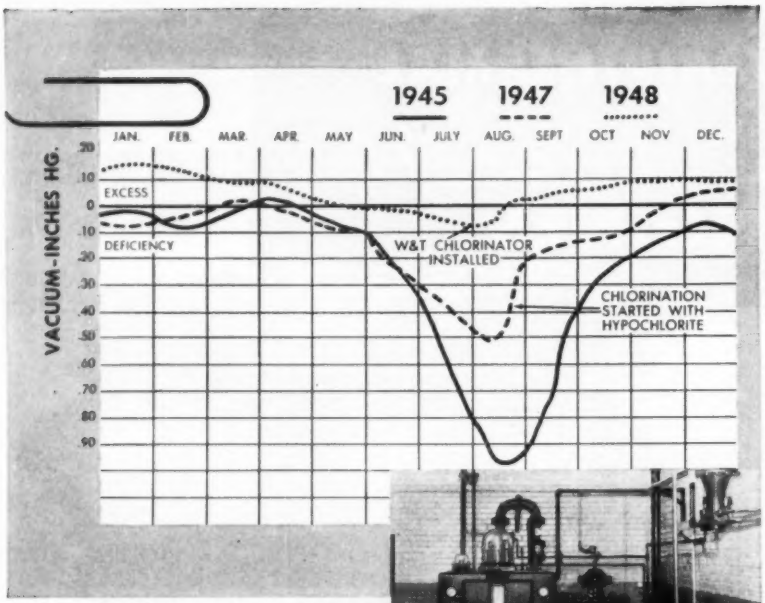
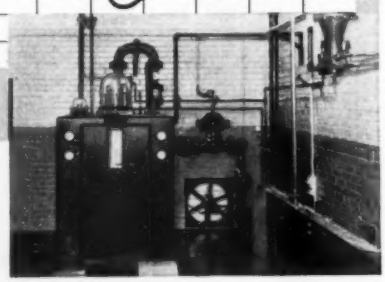
P253





PEAK CONDENSER PERFOMANCE...

... *with* W&T CHLORINATION

Condenser operating curves from the Greenidge Station of the New York State Electric and Gas Corporation, designed by Gilbert Associates, Inc., show clearly the effectiveness of slime control with chlorination and Wallace & Tiernan Equipment.

The 1945 curves record typical operation without chlorination—showing the serious drop in condenser vacuum during the warm water months. Early in 1947 chlorination was started by feeding hypochlorite, but not until August of that year was the dosage increased sufficiently to give appreciable slime control. Immediate improvement in condenser performance was evident.

The 1948 curve shows a full year of chlorination. The feeding of hypochlorite — although giving slime control — proved both expensive and difficult. To overcome these difficulties, a W&T Air Operated Master Chlorinator for feeding gaseous chlorine was installed in August 1948. Further improvement in performance was noticed as soon as the chlorinator was installed. After the installation, condenser vacuum even during the summer dropped only about 1/10 inch Hg. below "bogey" compared to a full inch loss during 1945.

You can put these benefits of Chlorination by W&T to work in your plant. Write today for additional information or to arrange a visit with your W&T Representative.

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WALLACE & TIERNAN PRODUCTS, INC.

CHLORINE AND CHEMICAL CONTROL EQUIPMENT

Belleville 9, New Jersey • Represented in Principal Cities

MARMADUKE

Continued from page 196

and walked majestically out of the fire room, whistling as happily as a lark.

The Chief and everyone else stood open-mouthed, staring into the furnace for a peek at the anvil. But it couldn't be seen. And it stayed exactly where it landed until that boiler was cut out weeks later in port.

After that, Matt Feeley never complained about dirty fires again. He took whatever Marmaduke left him. And Marmaduke collected plenty of blood money when he signed off in New York.

DEAERATING HEATER

Continued from page 80

duces a low steam flow through the heater and makes good deaerating heater operation somewhat dependent on good vent condenser operation.

Despite an added cost of about $15,000 to $25,000 for steam piping. Scheme A won out because of more assurance of good heater operation under all load, water and steam conditions.

Further, with a reasonably constant 24-hr operating load, scaling would be relatively low in the vent condenser. So external tubular designs were selected for both deaerator and hot-process softeners with a bypass, as shown in Fig. 3. Vent valve on the deaerating-heater vent condenser stays closed normally with the thoroughfare system, and all noncondensable gases vent from the hot-process softener.

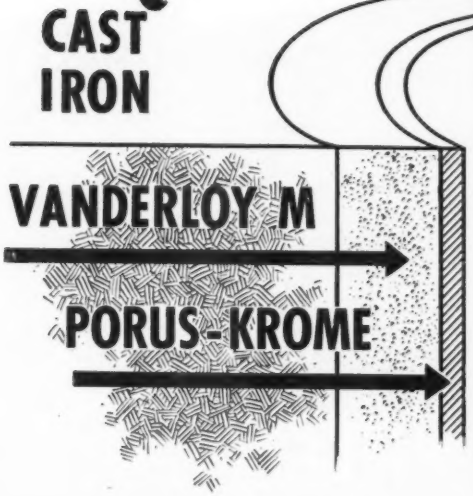
Spray-type deaerator internals appealed to the steel-mill operators because: (1) Entering water was low in alkalinity, although high in pH, and contained less than 1 ppm of total hardness. (2) Designers and operators had enjoyed considerable success with this class heater in the past. (3) Investment costs run about 10% less.

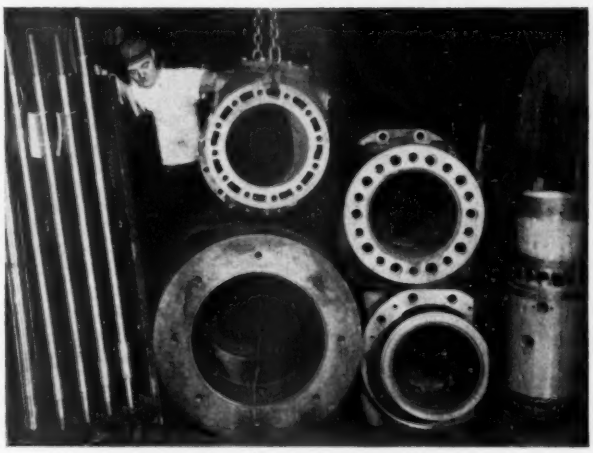
When it comes to the question of storage, about a 10-minute flow or 166,667 lb of deaerated water, can be stored in this deaerator, Fig. 5, up to the lip of the overflow. Hot condensate, to as high a flow rate as 250,000 lb per hr, can flow into the heater for deaeration. The hot-process softener ahead of the deaerator, Fig. 4, stores an additional 30-minute, or 500,000 lb of pretreated water.

There was still one other special possible service for deaerated water—that was desuperheating. As Fig. 3 shows, a very sizable process load exists for 200-psi steam and it is drawn from the 900-psi boiler output heater. It was finally decided that pure condensate could do the desuperheating best.

Deaerated, zeolite-treated water could

Reverse the Wear...





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* *PORUS-KROME is a dense, hard, wear and corrosion-resistant chromium, produced by the Van der Horst Corporation of America, and which gives working surfaces an infinite number of tiny oil-retaining reservoirs for perfected lubrication.*

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Why bother to have your liners oversized? Reverse the effects of wear — have your liners Van der Horst processed!

With VANDERLOY M we can plate back any liner you have to original size — and with PORUS-KROME* we can keep it that way.

A PORUS-KROME liner outwears as many as four unprocessed liners. Meantime, it uses less lube and fuel oil, delivers more power and is much easier on rings.

When such liners finally need replacing, simply slip in another set of Van der Horst Re-STANDARD-Sized liners — and send the worn ones back to us for renewal again.

Even liners you'd normally scrap are restored to original dimensions and each renewal pays pays for itself — several times over.

Of course the real profit comes when you eliminate the cost of stocking oversize parts — simply by having Van der Horst "reverse the wear" on all your liners. Let us show you how much can be saved by making this your standard practice.

W52-3D

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ONLY CYCLONIC COMBUSTION GIVES . . .

66% MORE POWER per sq. ft. of heating surface

By reducing heating surface requirements from 5 to just 3 sq. ft. per B.H.P., Cyclonic Combustion produces 66% more power per sq. ft.—saves up to ⅓ the space of conventional package steam generators. Cyclonic Combustion is the revolutionary new flame control used exclusively in Cyclotherm steam generators. Flame characteristics are controlled in a revolving spiral vortex traveling the full length of the furnace to insure maximum heat transfer without direct flame impingements or hot spots. The cyclonic action of the flame accounts for a 65 to 75% heat transfer within the main fire-tube. This high rate of heat transfer enables Cyclotherm 2 pass generators to maintain a guaranteed minimum efficiency of 80% for any steam requirement.

Cyclotherm steam generators with patented Cyclonic Combustion offer these additional features: Full power operation from a cold start in 15 to 20 minutes; Savings up to 50% on maintenance; Greater fuel savings; Boilers designed for oil or gas operation from 18 to 500 h.p., 15 to 200 psi operation pressure.

Proved superior in thousands of installations, Cyclotherm steam generators with new Cyclonic Combustion offer the most efficient and compact package steam generator on the market today. Find out more about Cyclotherm and Cyclonic Combustion—write today for a free illustrated folder.

The Cyclotherm meets all state requirements and is built in accordance with A.S.M.E. and National Board Standards and bears the label of Underwriters Laboratories, Inc.

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cause some solid deposits to build up in the steam lines. What is more, it would require (1) separate deaerating and storage-condensate section in the deaerating heater, making its internals much more complicated, or (2) separate, steam-blanketed condensate storage tank, properly vented.

COMBUSTION CONTROLS

Continued from page 94

the approved combustion safeguard.) (3) Limit the trial-for-ignition period of the main burner to not more than 15 seconds when an interrupted or expanding pilot is employed. (Note tha there is no trial-for-ignition period, nor can the main flame be supervised exclusively when using an intermittent or continuous pilot.)

Heavy-Oil Needs. Basic needs for oil-fired burners vary somewhat with the oil—heavy or light. For heavy, be sure of these four measures:

1. Provide approved safety shutoff valves in both main and pilot-burner fuel lines. (Supervise each main oil flame by a combustion safeguard approved for fuel oil, and if a proved pilot is used, for the type of pilot installed.)

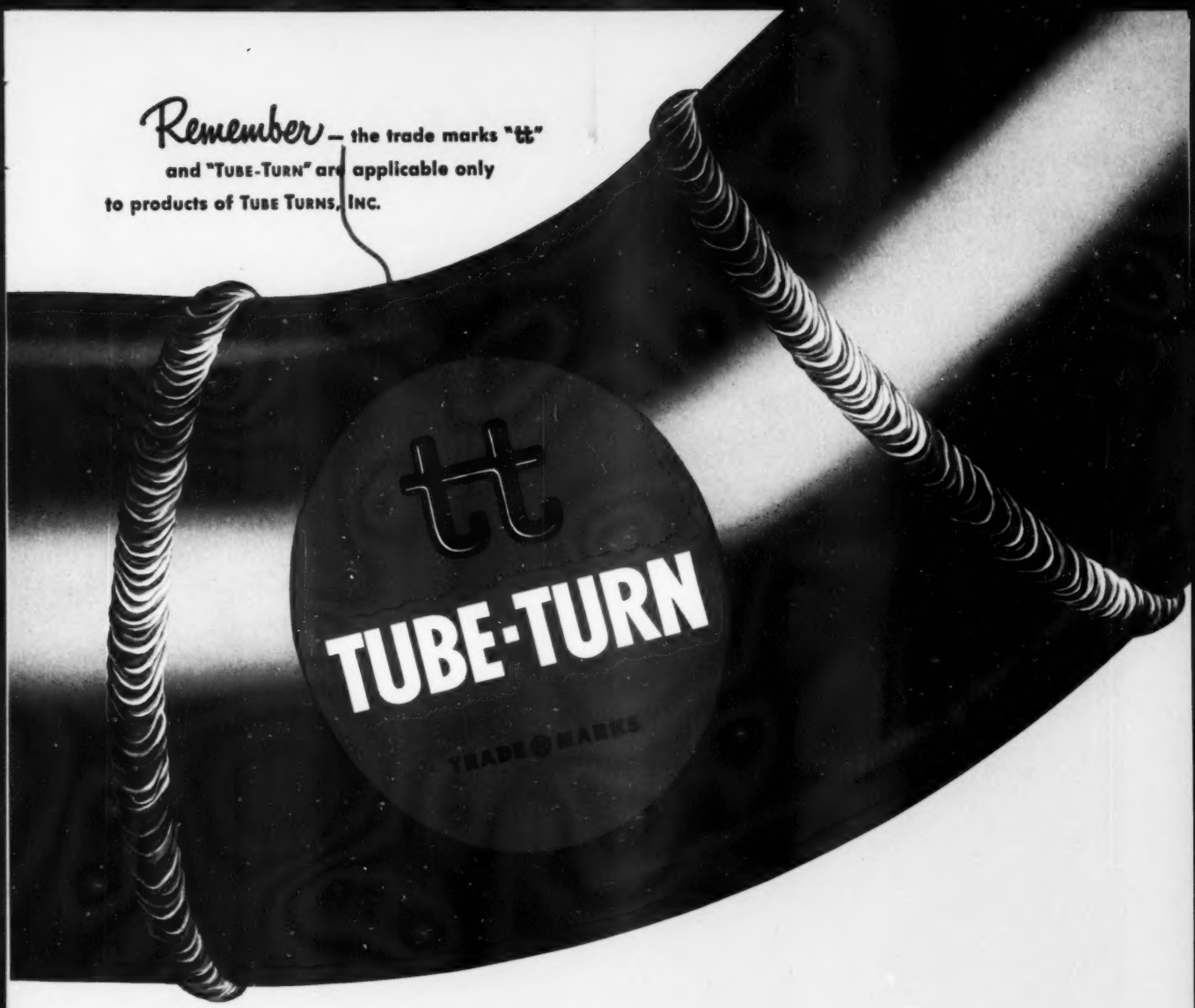
2. Provide a supervised interrupted or intermittent pilot and prove the existence of the pilot flame before permitting the main safety shutoff oil valve to open. (This supervision should be at the point where the pilot will reliably ignite the main burners. Limit the trial for ignition of the main burner to not over 60 seconds.) Note: An improved interrupted or intermittent pilot can be used if the trial-for-ignition period of the main burner is limited to not over 15 seconds, or if the gas pressure in the pilot gas line downstream from all manual valves is supervised by a pressure switch so, on lighting of the main and pilot burner, safety shutoff valves can open only when the pilot flame reliably ignites the main burner.

3. Light the oil burner at a firing rate not beyond 33% of maximum. Interlock oil and combustion-air controls so that upon a call for heat they must be in the low-fire position before the main oil valve can open.

4. Provide adequate oil-preheating equipment and temperature interlocks to guarantee oil at manufacturer's recommended viscosity. Arrange the piping and preheating system to minimize the slug of unheated oil standing upstream of the burner tip. This insures prompt ignition during the trial-for-ignition period.

Light-Oil Needs. Light-oil-fired burners do not require as involved precautions: (1) Provide approved safety shutoff valves in the main and any pilot-

Remember — the trade marks "tt" and "TUBE-TURN" are applicable only to products of TUBE TURNS, INC.



Engineered FOR MINIMUM PRESSURE DROP

THIS TUBE-TURN Welding Elbow has full radius conforming to A.S.A. Standard B 16.9. The radius is not reduced by tangents. The interior walls are consistently smooth and perfectly circular . . . important production features which minimize pressure drop.

This attention to engineering detail pays off in your piping systems. When you specify TUBE-TURN Welding Fittings and Flanges, pressure drop is at a minimum and uniformity of fit-up is assured.

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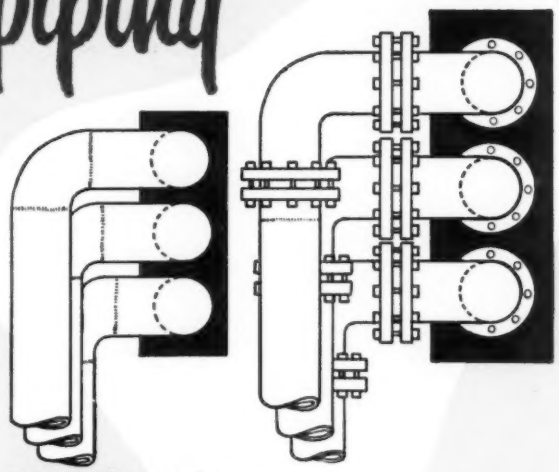
CONTACT WELDED PIPING SIMPLIFIES ANY JOB

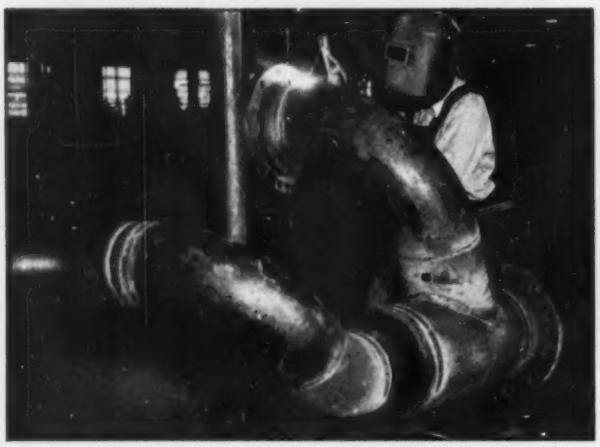
COMPACT *Welded piping* SIMPLIFIES THE JOB

You can simplify design, save valuable space and speed up the piping job by specifying *welded construction* with Tube-Turn Welding Fittings. Welded joints are virtually flush with the pipe. Pipes can fit snugly together in tight corners . . . against wall or ceiling . . . or around equipment. And welded piping requires little elbow room to install . . . and to insulate. The true circularity and uniform wall thickness of Tube-Turn Welding Fittings simplifies fit-up and assures a job well done under crowded working conditions.

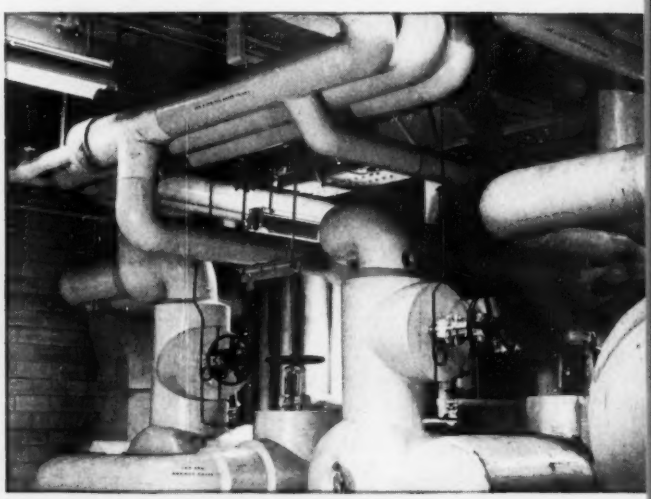
This is just one reason why it pays to specify *welded piping*. It's stronger, lighter, streamlined, economical to install, insulate and maintain.



Example: **The welded assembly on left takes a third less space than comparable flanged assembly.**



Bring on your tight corners! Entire sections of welded piping can be shop-fabricated and erected as a unit with a few simple tie in welds or flange connections to valves or containers.



In the new O. H. Hutchings Station of Dayton Power & Light Company. Piping for deaerators and feed water heaters is compact, streamlined and permanent. Directional changes are made with TUBE-TURN Welding Fittings.

Want Dimension Data?

Tube Turns, Inc. has compiled a handy folder of charts covering dimensions and weights of TUBE-TURN Welding Fittings and Flanges. If you'd like a free copy just send this coupon.

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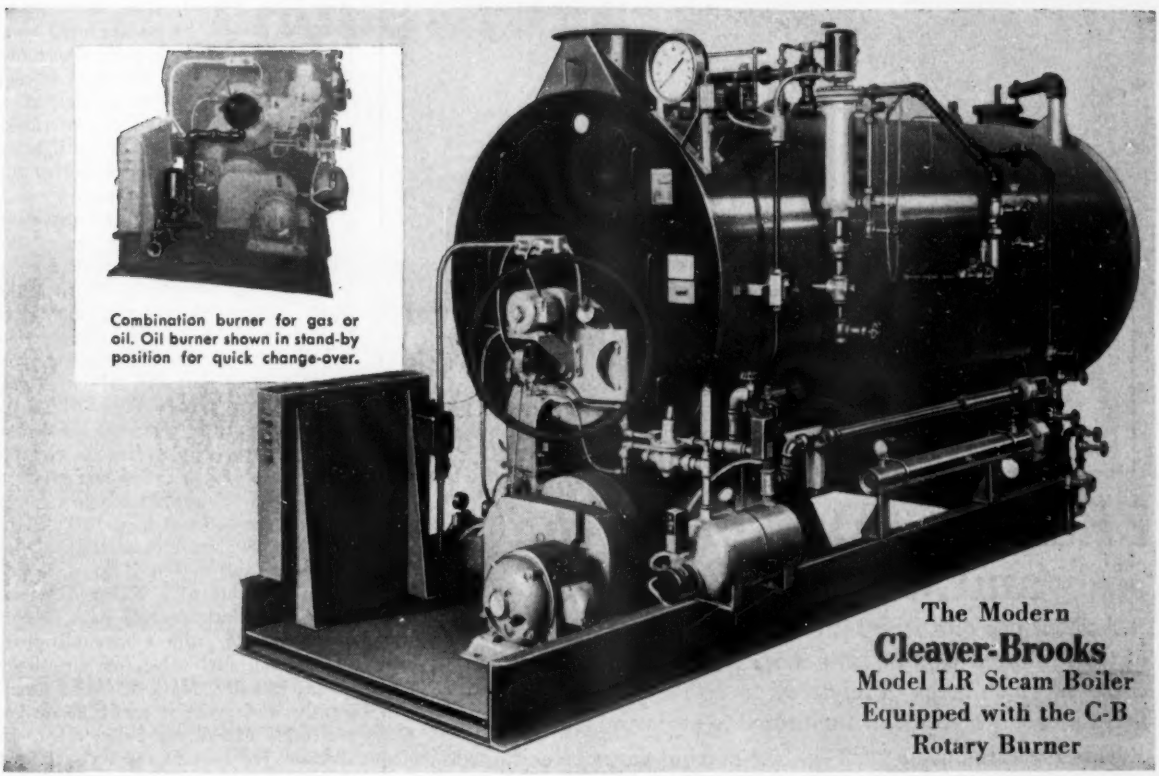
unmatched Flexibility of operation ...and of quick fuel change-over



Combination burner for gas or oil. Oil burner shown in stand-by position for quick change-over.

The Modern **Cleaver-Brooks** Model LR Steam Boiler Equipped with the C-B Rotary Burner

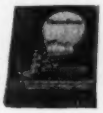
✓ **Quick Steaming—Fast, effortless response to fluctuating steam demands**

✓ **Equally high efficiency using heavy No. 6 oils (or lighter oils) and all types of industrial gas**

IF the quantity of steam required in your plant fluctuates throughout the day, depending upon the amount of steam-using equipment in operation, you can cut your steam costs substantially with a Cleaver-Brooks Boiler. It operates at a full 80% guaranteed efficiency whether you require maximum load use of all steam-using equipment . . . or whether your equipment is not in use, requiring as little as 30% response — often just enough to heat the plant.

Install a Cleaver-Brooks Boiler — oil, gas, or combination — either fuel properly proportioned by the exclusive Cleaver-Brooks Burner to meet your fluctuating or constant steam demand. Fully automatic, clean, with a single source for all of its matched parts . . . you benefit with lower fuel bills, less maintenance, reduced operating costs, greater profits. Why not consider changing your present boiler plant and think of flexibility — remember Cleaver-Brooks and get the complete facts on boilers, 15 to 500 HP — 15 to 250 lbs. psi.

Write for latest, fully illustrated and descriptive Cleaver-Brooks Steam Boiler catalog.



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STEAM BOILERS
the first and finest of their class

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Builders of Equipment for the Generation and Utilization of Heat • Steam Boilers • Oil and Bitumen Tank-Car Heaters • Distillation Equipment • Oil and Gas-Fired Conversion Burners

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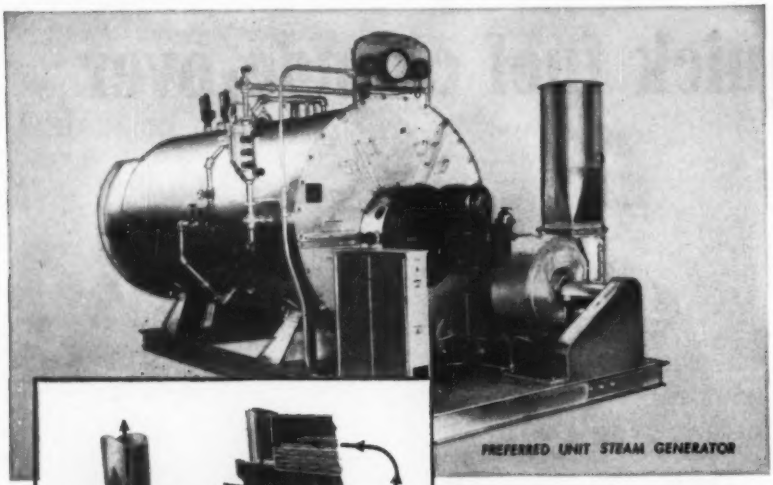

*Expansile Precipitator for maximum gas velocities in all tubes. This is another one of the many "Preferred's" 25 year built-in features.

PREFERRED *can do the job* and do it BETTER!

Another one of a long list of *exclusive* "quality features" of the Preferred Unit Steam Generator is the Expansile Precipitator which helps "Preferred" to do the job better . . . because it is designed and engineered to perform better!

This Preferred component enables maximum gas velocities to be equally maintained in all tubes of the pressure vessel. This is particularly important in the last pass where any drop in velocity (due to obstructions or insufficient mechanical impetus) results in rapid build-up of deposits. The expansile precipitator prevents this build-up, thus minimizing maintenance costs. The Preferred Expansile Precipitator is your overall insurance for clean, smokeless operation and healthful working conditions . . . trapped impurities *cannot* escape to surrounding areas.

The Preferred Generator gives economical, low-maintenance service at *a minimum guaranteed efficiency of 80%* . . . for twenty-five years. The Preferred Unit Steam Generator is insurance for optimum combustion based on automatic and simplified operation.

— This is only one of the many "quality features" described in Bulletin 2000 . . . for complete details send for your copy today.

PREFERRED UTILITIES MFG. CORP.

011 1860 BROADWAY • NEW YORK 23, N. Y.

COMBUSTION CONTROLS

Continued from page 200

burner fuel oils. Supervise each main oil flame by a combustion safeguard approved for fuel oil, and if a proved pilot is used, for the type of pilot installed. (2) Limit the trial-for-ignition period of the main burner to 15 seconds. Note: A trial-for-ignition period up to 60 seconds will be accepted provided a supervised-interrupted or intermittent pilot flame is used. Also, its existence must be proved, by an approved combustion safeguard, at a point where (1) pilot reliably ignites the main burner before permitting the main safety shutoff oil valve to open and (2) interlocks are furnished to insure low-fire lighting positions of the interlocks before the main oil valve can be opened.

Plant Protection. Over and above the recommendations for firing control the Factory Mutual survey suggests a number of plant protection steps. They begin where there are automatic sprinklers of combustible construction in boiler rooms, or where sufficient combustibles other than fuel oil are stored. Next, replace wooden floors with concrete extending 4 ft beyond the boiler unless there's ample, free-air circulation, enough to hold flow temperature below 160 F. Be certain, too, to arrange metal smokestacks at least 18 in. away from any combustible material. (You can reduce this to 9 in. if the stack has a 1-in. covering of well-seared insulation.) And last, provide each oil- or gas-fired boiler with a manually-operated shutoff fuel valve for emergency closing in a fire. Mark this valve prominently, and make it easily accessible preferably outside the boiler room. In addition, put in a fusible-link-actuated shutoff.

CANADIAN HYDRO

Continued from page 89

generators for fire protection. Provisions are also made for future installations of a CO_2 system, actuated by the unit split-phase relay protection.

Damper Windings. All medium- and large-size hydroelectric generators installed during the last 10 years by the Commission have damper winding in their pole faces. These windings (1) increase synchronizing torque (2) restrict high-induced voltages in the field windings on sudden system voltage changes (3) reduce overvoltage in the ungrounded phases of a system phase to ground fault.

Automatic Synchronizers. Units in all three plants have automatic synchronizers and automatic means for starting and stopping a unit by pushbutton control. Pushing the start button operates

one unit or a complete system . . .

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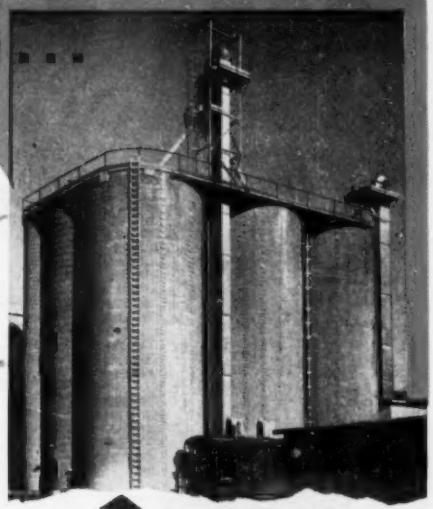

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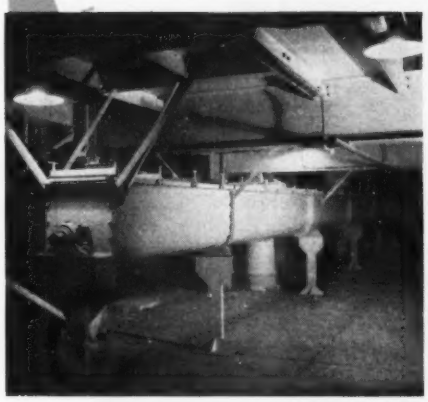

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SPIRAL CONVEYORS

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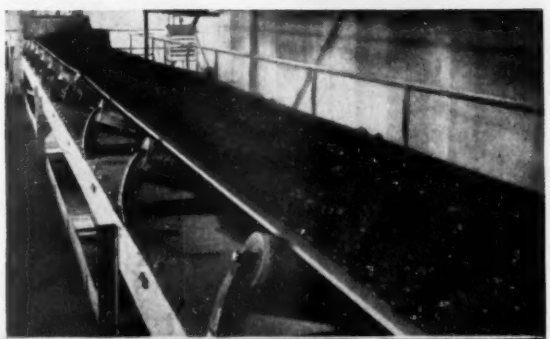

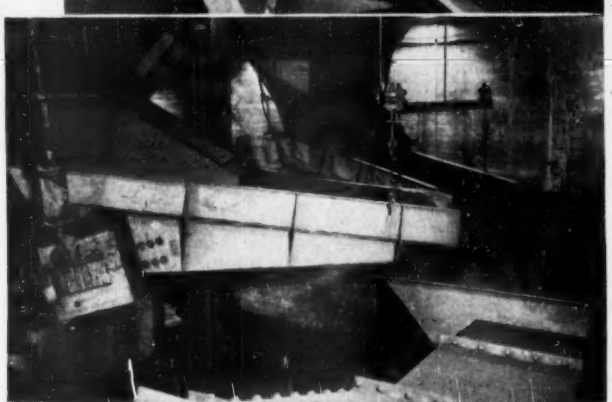

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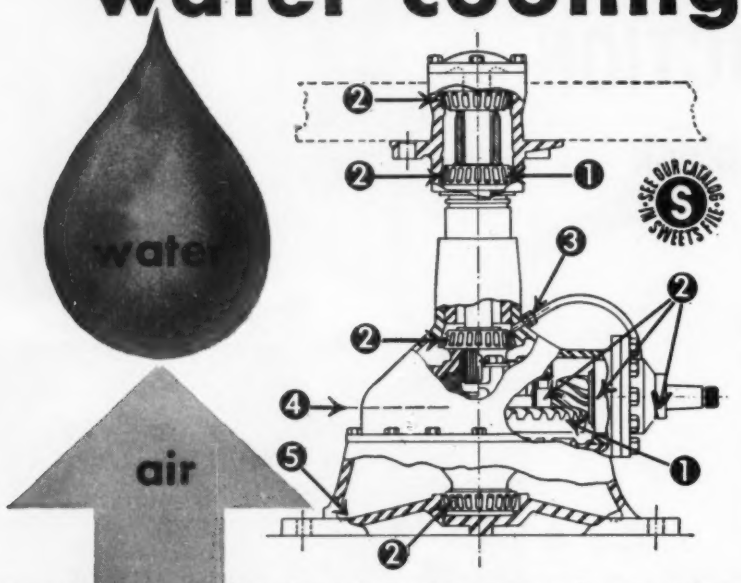

One of the most vital parts of a water cooling tower is the gear reducer which drives the fan. Smooth, positive power must be transmitted quietly from motor to fan. Water Cooling Equipment Company are the original designers of semi-floating axle gear reducers for water cooling towers, the best type for this use.

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a solenoid on the governor's pilot valve to open the turbine gates, the governor controlling the speed. When the unit is within 5% of normal speed, the automatic synchronizer takes control, adjusting frequency, voltage and phase angle of the unit to match those of the system. Then it closes the circuit breaker after which the operator takes control to adjust the load and voltage. When taking a unit out of service, after reducing the load to zero the operator pushes the stop button. This actuates the governor's solenoid to close the gates. After speed drops to about 50%, brakes are applied automatically to bring the unit to rest. These automatic devices save time when starting and stopping and insure uniform accuracy in synchronizing.

LUBRICANTS

Continued from page 77

both graphite and molybdenum disulfide is believed to be similar, centered about a unique laminar molecular structure. Both materials form on a surface oriented layers that slide over each other with ease.

Solid lubes are used most effectively where "conventional" lubricants are not suitable for some reason. Typical is where a device is seldom called on to operate and yet must be ever ready. Many applications are cropping up in electronics. Here the use of fluids or greases is often ruled out because of creepage onto adjacent electrical contacts and possible dust collection. Another application is in a reactive surrounding, as in presence of fumes from a chromium plating bath.

Development work is under way in the field of resin-bonded mixtures of graphite, molybdenum disulfide and soft metals. In the field of resin coatings most of the work is in connection with military applications.

COMBUSTION AIR

Continued from page 102

cant because it is advantageous to supply engines with air as near saturation as possible. This is particularly true for gas engines. Here humidity suppresses detonation, gives more orderly flame propagation and a lower mean temperature in combustion chamber. Same is true for diesels, but it isn't considered as important as on high-compression spark-ignited gas engines.

Fig. 6 shows a patented system now in use on 4-cycle turbocharged gas, gas-diesel and diesel engines. Evaporative cooler reduces air temperature to within 7 F of prevailing w-b while aftercooler lowers air temperature to within 25 F of

M. W. KELLOGG

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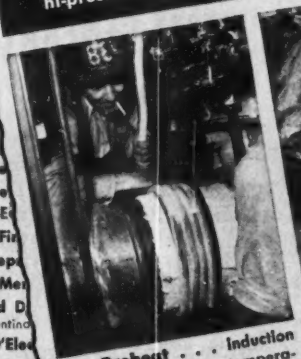

The Preheat . . . induction heating at optimum temperature assures crack-free weld.

First Bead . . . senior-engineer supervised . . . complete fusion, uniform backing ring penetration are "musts."

No Letdown . . . slag-free surfaces, uniform weld-metal deposits, constant temperatures on each successive layer.

Finished? . . . welding completed, yes . . . but then comes Radiographing and vital multiple hour stress relieving.

engineers have now evaluates its position. Adhering over the better thought. It's a fact that years to the principle of close integration all of the meticulous work done in the of basic research, engineering fabrication pre-fabrication of critical alloy piping and construction—Kellogg believes there sub-assemblies can be undone through is no better demonstration of its value improper field assembly and welding. than the demand for Kellogg pre-fabrication and installation of critical electric utility piping.

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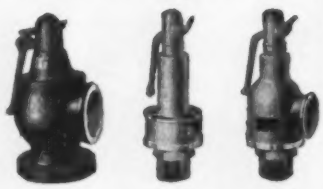

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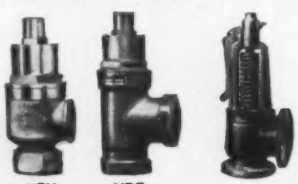

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COMBUSTION AIR

Continued from page 206

cooling-medium temperature. Wider approach of aftercooler is a compromise dictated by space limitations.

Typical 4-cycle engine with inlet air at 115-F d-b, 65-F w-b at 3000 ft elevation, with a charging pressure of 15 in. Hg, receives air at 225 F without conditioning equipment. With conditioning, results are:

Initial conditions	115-F d-b, 65-F w-b
After evaporative cooler	72-F d-b, 70% rh
After turbocharger	182-F d-b, 5% rh
After aftercooler; combustion air supplied engine with 80-F water	105-F d-b, 37% rh

Supercharged engine fitted with the more efficient combined aftercooler-evaporative cooler in Fig. 7 receives air as follows:

Initial conditions	115-F d-b, 65-F w-b
After turbocharger	225-F d-b, 5% rh
Air from aftercooler	105-F d-b, 6% rh
Air from evaporative cooler to engine	71-F d-b, 66% rh

Space limitations govern the size of equipment usable on engines of this type. Improved cooler designs permit conditioning of combustion air to values indicated above. Cooling of combustion air is one step but true conditioning of combustion air offers more advantages in providing higher efficiency, more reliable prime movers.

WITH OUR READERS

Continued from page 5

parts of a complex, monolithic, rigid frame, with infinite degrees of freedom, of such sizes that their weight cannot be neglected and the loading is usually partially uniform. Consequently, computations based on single degree of freedom may not be adequate.

Structural engineers, as a rule, seldom are well versed in the theories of vibration. However, the following suggestions may be applied without higher mathematics:

1. Turbine foundation should be thoroughly analyzed as a rigid frame for all possible vertical and horizontal loadings.

2. From the moment analysis, an envelope of the maximum and minimum moments should be plotted. From this, an approximate degree of fixity for the girders can be established.

3. Using the formula

$$f = \frac{a_n}{2\pi}\sqrt{\frac{E\,I}{u_1\,l^4}}$$

establish the first few modes of natural frequencies of vibration. The coefficients a_n should be interpolated in the ratio of fixity

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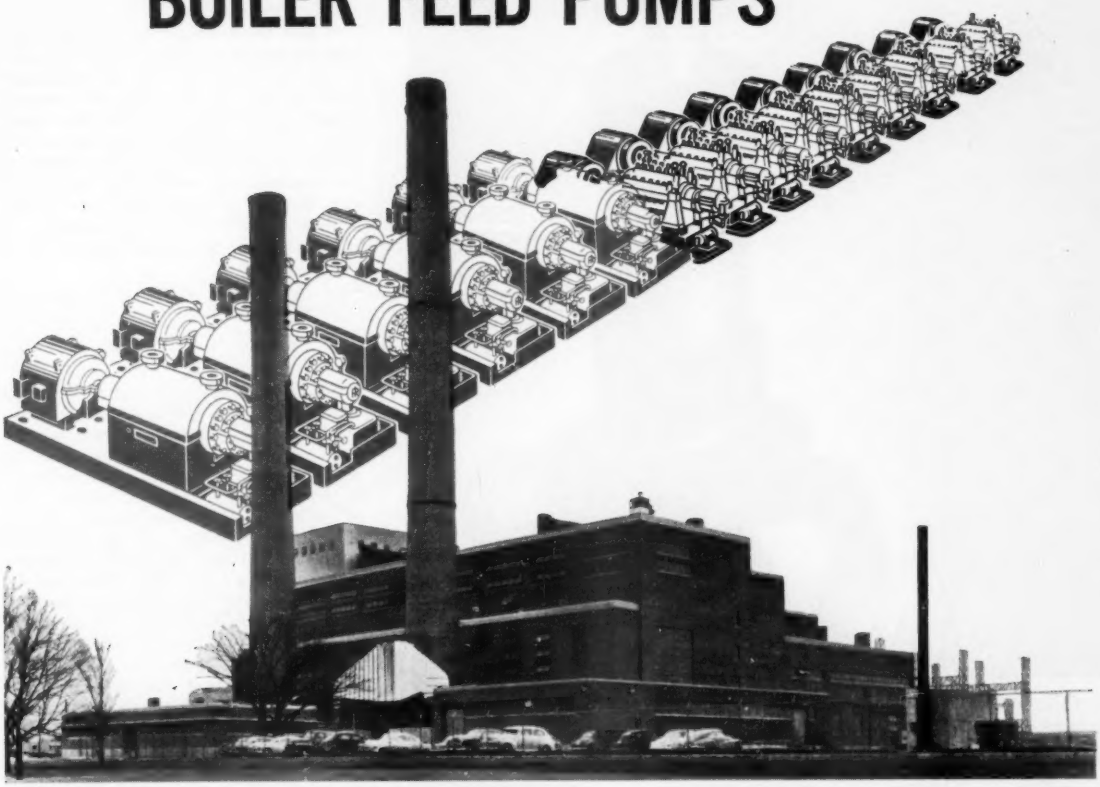

Six 9-Stage CHTA high pressure pumps will serve two new 68,000 kw units at this fast-growing station of Indianapolis Power & Light Company

INGERSOLL-RAND is proud to have been associated in every phase of the development of the new White River station. At this modern plant, the three 45,000 kw units already in operation are served by nine I-R Class HMT, 8-stage boiler feed pumps.

To keep plant capability abreast of increasing load demands, two new 68,000 kw units are now being added. Unit No. 4 is to be put into service in December 1952 and No. 5 a year later. Six 9-stage, 4-inch Class CHTA "double case" pumps will serve these units—driven by 900 hp motors and delivering 708 gpm of 303° feed water at 1565 psi.

Other I-R pumps at White River include vertical circulating and condensate pumps for the five I-R rectangular condensers, evaporator and chlorinator feed pumps and a host of general service units. This installation is another example of the wide variety of pumps offered to the power generating industry by Ingersoll-Rand. Your nearest I-R branch office will be glad to consult with you on your pumping problems.

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WITH OUR READERS

Continued from page 208

as noted under (2). If none of the modes has similar values to the unit's speed, resonance will not likely occur.

4. As an extra precaution, compute the maximum deflection due to flexure and shear. Then, using the formula

$$f = \frac{1}{2\pi}\sqrt{\frac{g}{\text{defl}}} \quad *$$

establish the frequency of the equivalent simple system.

It may be interesting to mention a turbine-foundation construction recently completed in France. Instead of rectangular cross sections for the reinforced concrete members, "I" shaped sections were used. Thus, while maintaining a large moment of inertia, the possibility of adding weight to the members was provided for, in case of objectionable vibrations that may develop because of unforeseen circumstances.

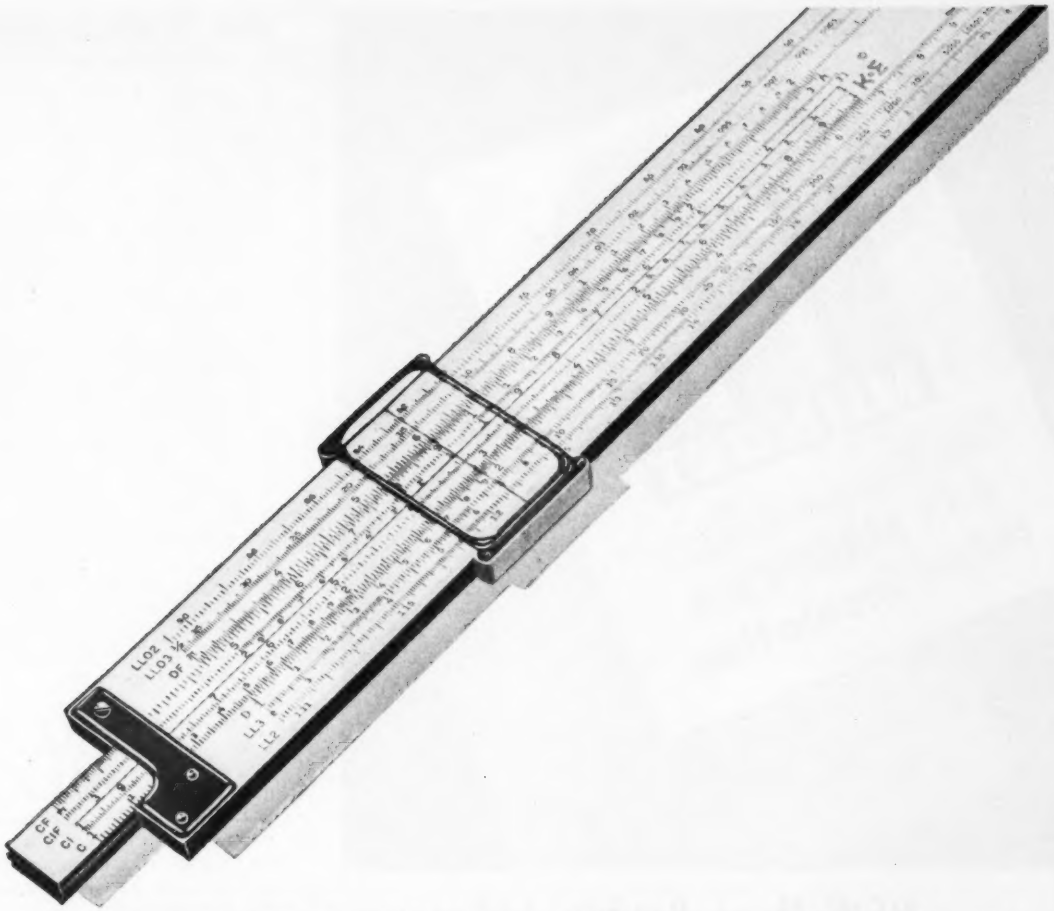
PAUL ROGERS, *Structural Engineer*
Chicago, Ill.

* See Den Hartog's *Mechanical Vibrations*, or other books on vibrations.

Production, processing and distribution of petroleum soared to new all-time peaks in 1952 as the American people, for the tenth consecutive year, consumed more oil products in more ways than ever before in history. In a year-end report on the U.S. oil industry's 1952 accomplishments, Frank M Porter, President of the American Petroleum Institute, said domestic demand approximated 2 billion 650 million barrels, and total demand (which includes exports) exceeded 2 billion 800 million barrels. He described the 1952 increase, three per cent, as "modest" in comparison to the larger gains of recent years. He said this could be an indication that the post-war surge in petroleum demand is now levelling off to an area of more normal growth. Porter also noted that the industry's capital expansion program for 1952 anticipated spending more than four billion dollars—an increase of nearly 25 per cent over the 1951 total.

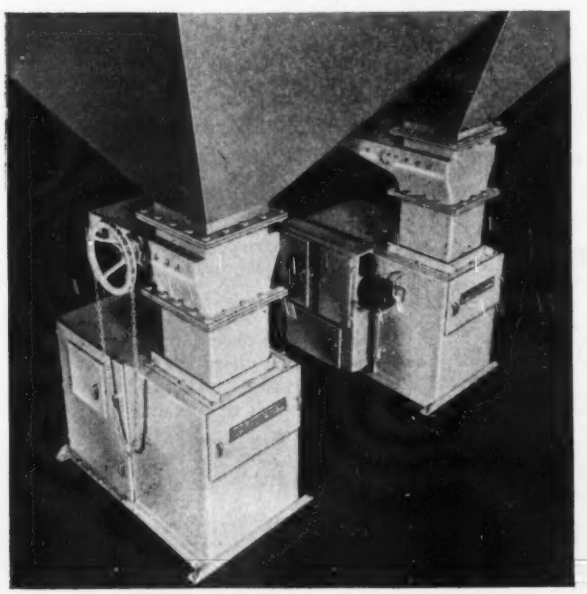
The world's power requirements may someday be met entirely with atomic energy, while coal and petroleum are used chiefly as chemical sources of industrial products, Dr George Curme Jr, vice-president of the Union Carbide and Carbon Corp, New York, said at the Pittsburgh Award dinner of the American Chemical Society's Pittsburgh Section.

McGraw-Hill World News, The Hague: Dutch atomic scientists are seeking funds from industry and government to set up an atomic "power breeder," Dr W J Beekman, Director of the Netherlands Foundation for Fundamental Research has disclosed. A contract is expected to be signed shortly with leading Dutch electricity companies who would contribute 125,000 guilders per year for a period of five years and make available laboratories and services. Dr Beekman said that some leading industries were prepared, in principle, to contribute similar amounts to the project.



The B.T.U. Chaser With a Slide Rule

Two S-E-Co. Automatic Coal Scales with S-E-Co. Coal Valves feeding pulverizers.



must have available accurate information of coal input to calculate the efficiency of each boiler. S-E-Co. Coal Scales provide this data for any desired time period.

S-E-Co. Coal Scales, weighing coal to the individual pulverizers, also allow the pulverizer feeders to be balanced. In this way each burner may be adjusted to give the maximum CO_2 percentage and may be operated at its highest efficiency, hour after hour.

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Begins on page 154

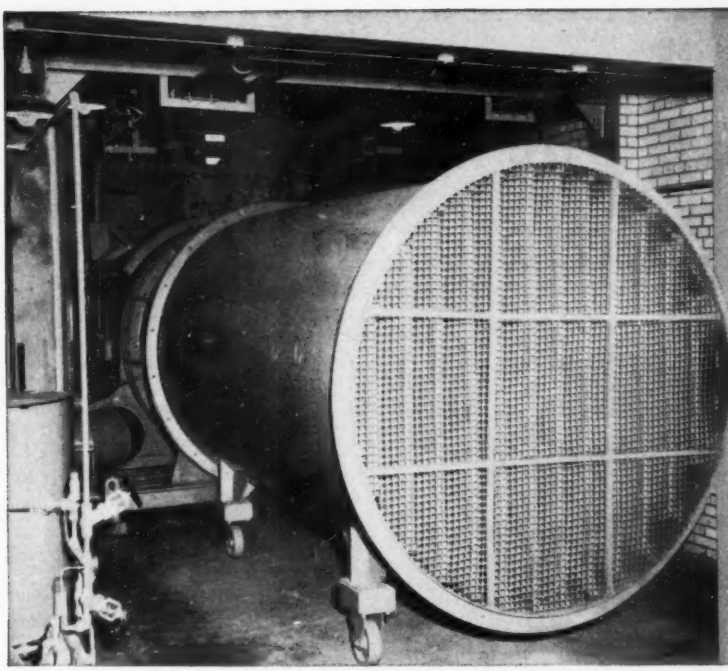
ing the exhaust stack. In this particular installation, the ratio of ventilating air pumped to ambient combustion air was 0.67. This ratio will of course be a variable dependent upon the turbine exhaust velocity, relative stack sizes, the ventilation air inlet area, and the configurations of the inlet air system and the inlet to the stack annulus. *ASME Paper No. 52-A-130.*

Rotary Regenerator Effect on Gas Turbine Plant Performance. *By D B Harper and W M Rohsenow, MIT.*

The efficiency of a simple gas turbine plant can be increased by using a regenerative cycle in which a heat exchanger is used to transfer heat from the hot turbine exhaust gas to the cooler compressor discharge air. Generally the type of heat exchanger considered for gas turbine applications has embodied a stationary wall separating the hot and cold fluids, These have commonly taken the shell and tube geometry, arranged for either counter flow or cross flow passes.

The suggestion that a rotary type regenerator, similar to the Ljungstrom air-preheater, be used as a gas turbine plant regenerator is generally attributed to Ludolf Ritz. In the particular illustration used in this paper the regenerator consists of a compartmented rotor disk to carry the energy storage material (or matrix), a system of sealing shoes bearing against the rotor faces, and the necessary ducting to conduct the flow of gases. The rotor compartments together with the sealing shoes prevent the direct flow of high pressure air into the low pressure gas stream, but allow the free flow of air and gas in their respective paths. The matrix elements, which are carried in the rotor compartments, have thus been separated from the pressure retaining components of the regenerator and can take on any form which gives the required heat storage characteristics in combination with a sufficiently small pressure drop. The matrix elements may consist of packings of wire mesh or expanded metal, or various arrangements of corrugated sheet metal. As the rotor rotates, heat is transferred to the matrix while in the exhaust gas stream and heat is transferred from the matrix while in the cooler compressed air stream.

The principle advantage of the rotary regenerator is the possibility of designing a more compact unit than is possible with the conventional shell and tube or plate fin stationary surface type. Calculations, such as those of Cox and Stevens show that as passage diameter is reduced to very fine dimensions, heat exchanger volume, for a given effective-



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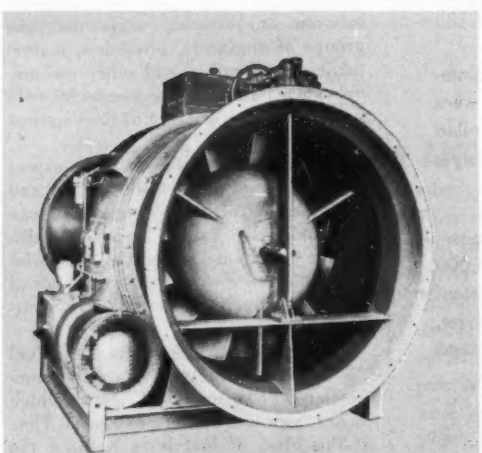

JOY Fan with sound-absorbing set removed

The illustration above shows a JOY Axivane Forced Draft Fan (rear) and its sound-absorbing set (front) installed under a pressurized-type boiler in minimum headroom—one of the advantages of its compact, highly efficient vaneaxial design. Other advantages are: favorable air volume-to-power ratio, low noise levels, easily installed, readily accessible, and trouble-free operation with least maintenance.

Principal advantage, however, is the great saving on power at reduced volumes. JOY Forced Draft Fans employ *variable-pitch blades,* manually or automatically controlled, as desired. For example, compared to other volume control methods, at 50% of rated volume JOY Variable Pitch requires only 25% of rated power, against 45% for Vane Control and 70% for Damper Control. ● Let us engineer *your* forced draft requirements and demonstrate the savings possible.

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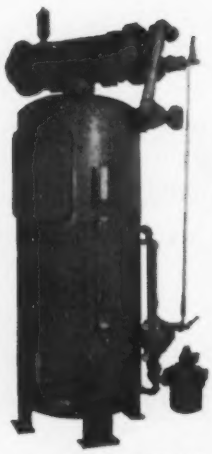
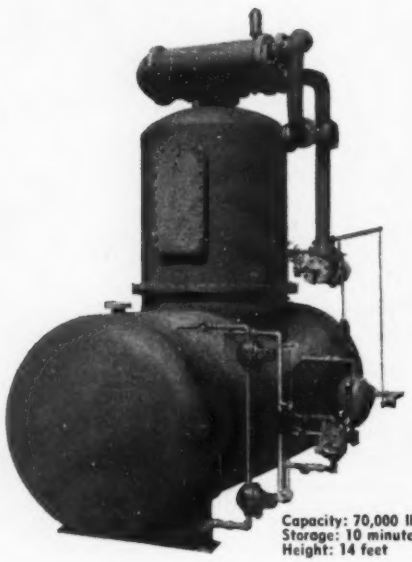


Cacapity: 7,000 lbs.
Storage: 5 minutes
Height: 10 feet



Capacity: 70,000 lbs.
Storage: 10 minutes
Height: 14 feet

● To cut fuel costs, improve boiler performance, and lower boiler maintenance, these two Stickle deaerating spray type feed water heaters were selected for new hospital buildings. The unit style heater (left) was installed in the administration building of a New York hospital; the storage style heater (right) in a Pennsylvania veterans hospital.

Stickle boiler feed water heaters—deaerating and non-deaerating types—are custom built to handle any feed water problem. Capacities: from 5,000 to 300,000 pounds per hour. Spray or open coil tray design, with steel or cast iron shell. Fuel savings from 10 to 15%. In deaerating type, oxygen content reduced to .005 cc per liter of water. Results guaranteed on every installation.

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Begins on page 154

ness and pressure drop, can be reduced appreciably. The matrix of the rotary regenerator can be finely divided, without structural difficulty and the resulting matrix volume may be one tenth or less than the corresponding tube-bundle volume of a conventional heat exchanger. The sealing and ducting arrangements, etc, especially for multidisk regenerators of larger capacities, would occupy a considerable volume but indications are that a regenerator could be built to occupy perhaps 1/3 or ¼ of the volume of a conventional heat exchanger. *ASME Paper No. 52-A-149.*

The Use of Residual Fuel Oils in Gas Turbines. *By F Draper, Shell Petroleum Co. Ltd.*

The gas turbine has arrived and it has come to stay. Fundamentally it is a sound conception, which is readily appreciated if an unbiased comparison is made between its mechanical simplicity and the construction of any other heat engine. If further proof is required, it is only necessary to appreciate the relatively rapid rate at which it has been developed to make a stand against its competitors. Nevertheless, the problems of the cycles of operation, the aerodynamic design and the method of releasing the potential heat of the fuel into the gas stream are capable of solution in so many ways that the groups of engineers, physicists, mathematicians, chemists and other technologists concerned have a wonderful field before them for arriving at their optima solutions.

In this paper one part of one aspect are discussed, namely the efforts and achievements of British and European technologists in solving some of the difficulties encountered in the otherwise satisfactory use of the cheaper types of fuel oils, namely ash deposition on turbine blades.

It points out that such grades of fuel oils all form some sort of ash on combustion unless they are refined which raises them to a higher price level. Thus if this class of fuel is to be used the gas turbine must be made capable of digesting it.

It continues with a theory, based on experimental work and confirmed by practical tests, concerning a method of reducing or eliminating this trouble by control of combustion conditions. It is not claimed as the only method but as one worth following up. *ASME Paper No. 52-A-127.*

The Closed Cycle Gas Turbine Power Plant. *By S T Robinson, American Turbine Corp.*

The author believes the closed cycle

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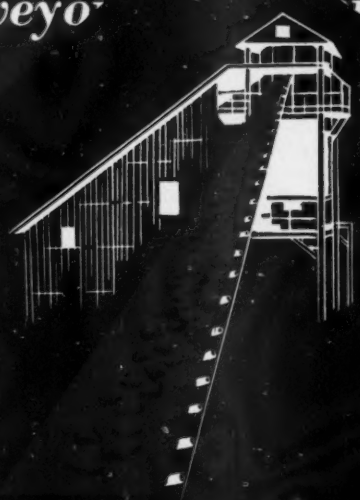

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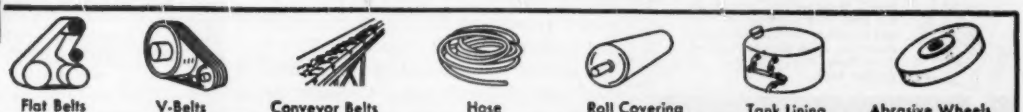

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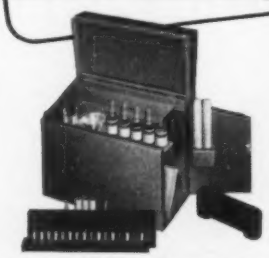

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Begins on page 154

gas turbine plant can find its best field of application in selected central station, industrial and marine fields.

The power plant was originally conceived and designed for electrical power generation where better efficiencies than then existed with steam were demanded and where the power limitations of the open cycle plant precluded its use with a single flow turbine to outputs of the order of 10,000 kw.

Plants for power generation run at constant speed and can therefore be single shaft sets. Reduction gears will be required with plants of small outputs. A separate power turbine will be required with plants of medium output and large output plants can operate with the generator directly coupled to the machinery set.

In addition to power generation waste heat from a closed cycle gas turbine plant is available in cooling water which can be released as steam or hot water. The amount of waste heat that is used in processing will not affect the power generation efficiency, contrary to the case with an extraction steam turbine. Such a scheme is being developed by Escher Wyss for district heating in a central European city.

Very often the fact is overlooked that the gas turbine is currently being developed in the lower power range because of its high efficiency compared with the steam plant, as the efficiency of the latter will drop considerably in sizes of less than 10,000 kw. The efficiency of a closed cycle gas turbine plant will drop less than three points from a 10,000 kw design to one of 2,000 kw which makes the smaller size plant extremely attractive for industrial use.

In the chemical and petrochemical industries as well as a great number of manufacturing processes waste heat is available in the form of high temperature exhaust gases. It is normal practice to raise steam in waste heat boilers for steam heating, processing, etc. as the erection of small steam turbine power plants is not economical. If exhaust gas temperatures of 1400 F or higher are available it is easy to obtain a circuit air temperature of as much as 1200 F without too great a capital expenditure for transfer surface. It is then possible to install a power plant utilizing at least 25% of the heat contained in the process exhaust gases over a temperature range of 600 F, for power generation, leaving the remainder for raising steam if required. This is the system being installed by Spencer-Boncourt of London in a Coventry gas works.

While but three general fields of application have been discussed here,

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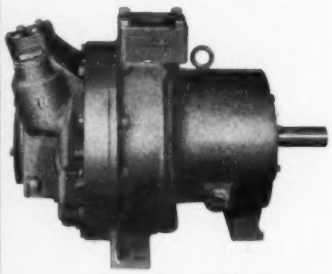

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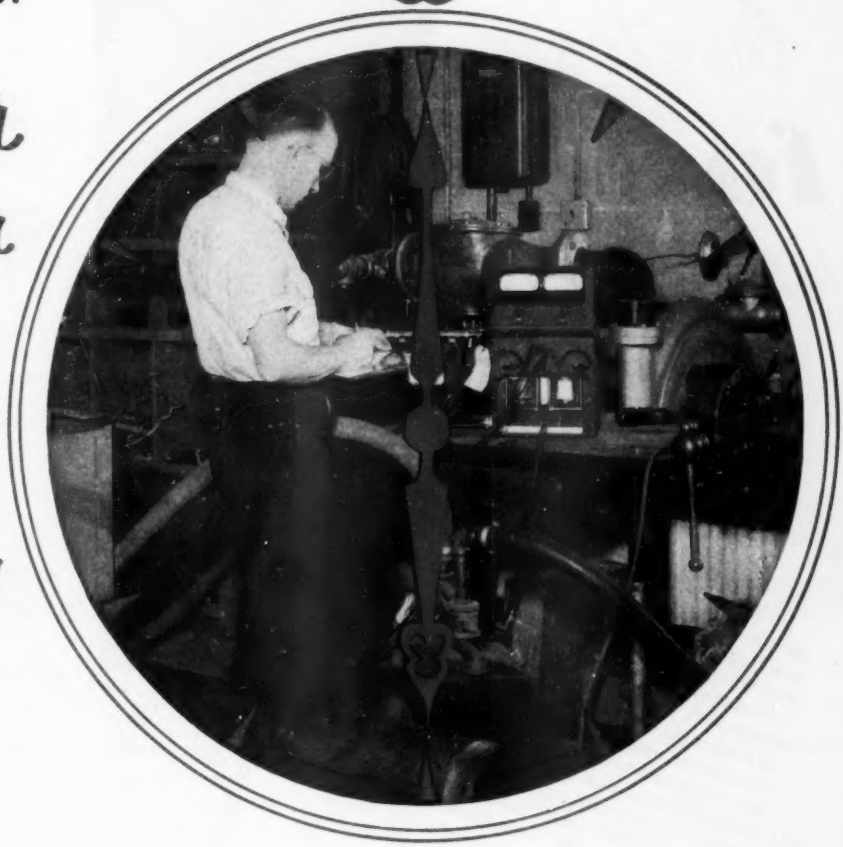

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More TECHNICAL BRIEFS

Begins on page 154

these to us are the most promising. The closed cycle gas turbine is not a universal power plant but it can do a job better in some fields than other types of plants, and only time will allow it and other thermal power plants introduced since the war to find their right place in the power generating field. *ASME Paper No. 52-A-137.*

Rotary Regenerative Air Preheater for Gas Turbines. *By A T Bowden and W Hryniszak, C A Parsons & Co.*

The advantages of the regenerative type heat exchanger are that small hydraulic diameters can be readily attained, and that when the normal counterflow arrangement is used the matrix is self-cleaning to some extent, particularly during that part of the operating cycle when high velocities and pressure differences are experienced. Against this must be taken the problem of providing an efficient seal between the air and gas flows.

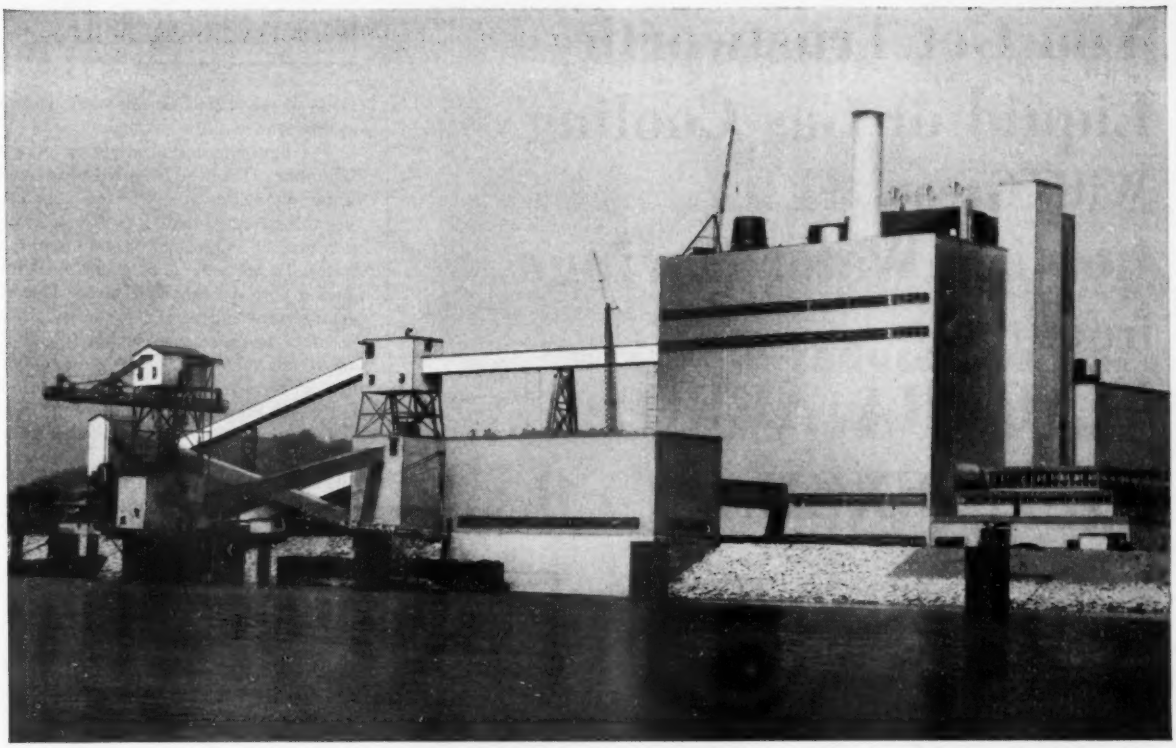
In comparison, if flame trap matrices are employed in both, the recuperator can be designed to have hydraulic diameters of the same order as those in the regenerator. The matrix, however, is not self cleaning, and thus continuous outside provision must be made to keep it in working order. This necessarily involves an equivalent power loss, but one which can justifiably be compared with the auxiliary power losses of the regenerator. The separation of the gas and air flows, however, must be made in the matrix itself, which complicates the problem of cheap and simple manufacture.

The inter-relation of these advantages and disadvantages especially that concerning the problem of sealing the regenerator, and the effective cost of its solution, will be the main criteria in the assessment of the relative merits of the two types of heat exchanger. *ASME Paper No. 52-A-74.*

Miscellaneous

Design and Calibration of A New Cavitation Laboratory. *By Hans Ulmann and R S Sproule.*

The Dominion Engineering Works, Ltd, new cavitation laboratory described in this paper is used for testing a wide range of hydraulic turbine model designs, from francis types with specific speeds as low as 18 under heads as high as 80 ft, to propeller types with specific speeds as high as 180, under heads down to 25 ft. The paper covers many special features provided in the laboratory to insure accuracy of test results and to reduce operating costs and includes de-



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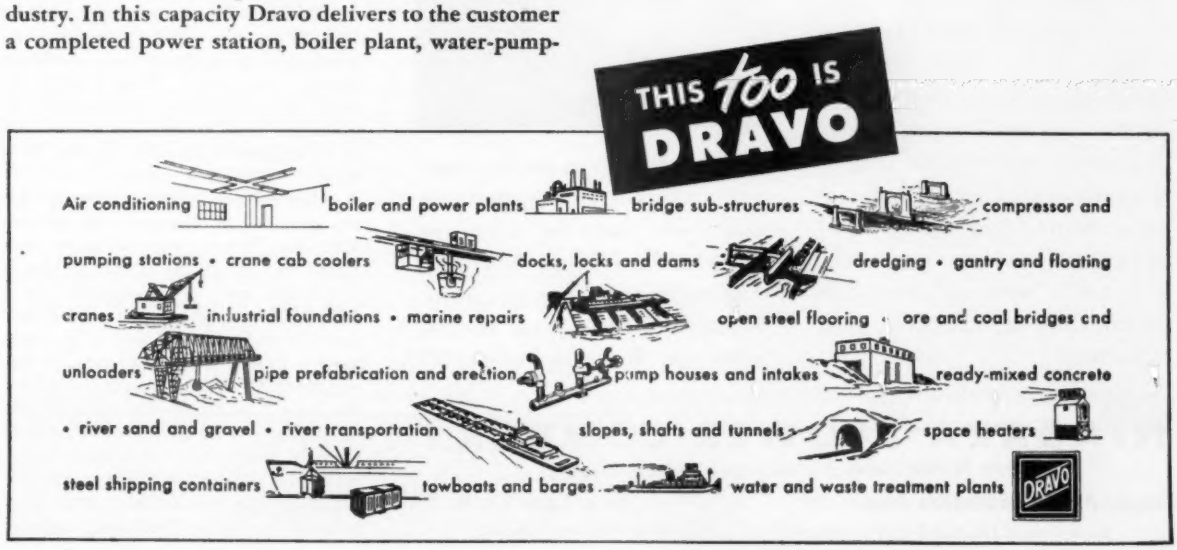

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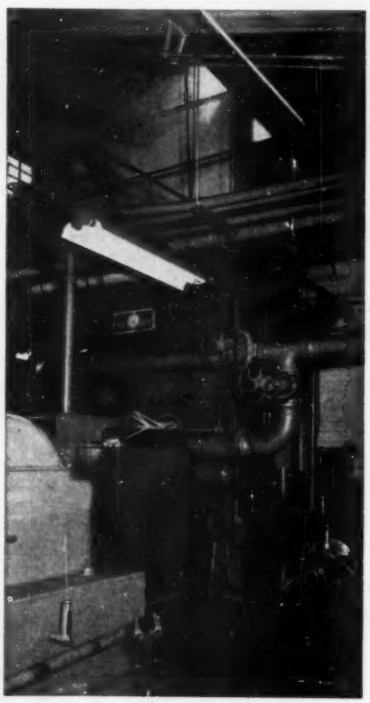

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More TECHNICAL BRIEFS

Begins on page 154

tails of instrumentation, the control system and calibration technique.

The figure is a flow diagram of the laboratory. The widely varied heads and water quantities are obtained with adjustable-blade propeller pumps. Cavitation may be influenced by the air in the water. To keep the air content constant during tests a resorber is used. This is a large tank where the water is under pressure for considerable time, so that air which comes out of solution under low pressure in the turbine runner and draft tube may be resorbed.

From the main outlet of the resorber the water goes through one of four venturi-meter tubes. The plate-steel head tank is about 10 ft in diameter and 7 ft high in which model turbines with a 16-in. throat diameter are placed for testing. A large part of the energy supplied by the pumps is not absorbed by the turbine and heats the water circulating in the system. Cooling equipment is installed in the resorber to hold the water temperature about constant. *ASME paper No. 52-A-95.*

Recent Developments and Progress in Air Pollution Control. *By A D Brandt, Bethlehem Steel Co.*

The effects of air pollution may be divided conveniently into five main groups. They are (1) nuisance, (2) economic, (3) effect on health, (4) on vegetation, and (5) on animals.

The nuisance aspects of air pollution are well known. It is very common to have action brought against an industry by a community, by an individual, or by another industry because of an alleged nuisance created by atmospheric waste discharged by the industry. These cases are sometimes very difficult to arbitrate or adjudicate because of the absence or lack of meaning of scientific data. At what point does atmospheric pollution become a nuisance? Even if a careful study is made of the concentration of gases and solid material in the air and of the amount of dust fall, at what level does it constitute a nuisance?

Other familiar effects of air pollution are economic in character. As early as 1912 one investigator estimated that smoke and gas in the air in the city of Pittsburgh cost its inhabitants about $10,000,000 annually. It has been estimated that the air pollution in St. Louis prior to 1940 cost the inhabitants of that city about $14,000,000 annually, and the economic losses caused by air pollution is costing the United States an estimated $1,500,000,000 annually. It can hardly be denied that the laundry bill is higher in grossly polluted areas than in those having less pollution, and the

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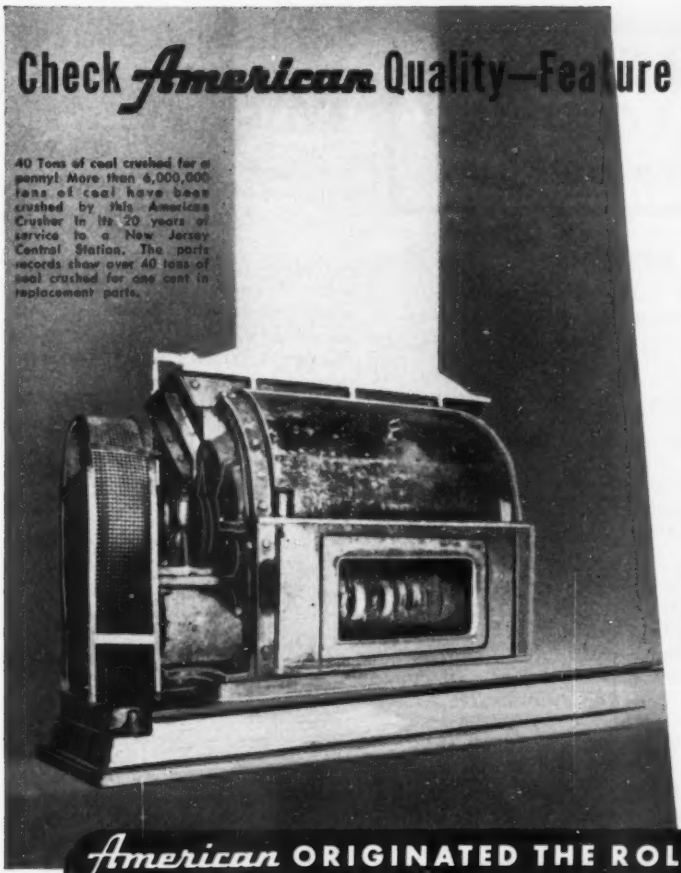
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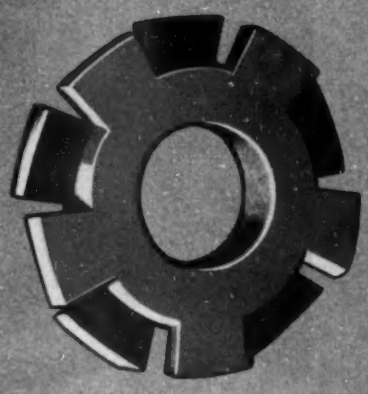

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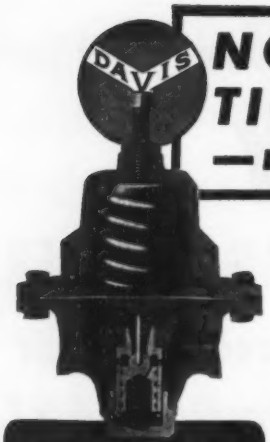

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Begins on page 154

cost of frequent "face-lifting" operations on blackened buildings is also higher in cities having much atmospheric pollution. Also economic but of a different type are the damage awards made to individuals or communities for injury to buildings.

That severe air pollution can have acute effects on the health has been illustrated in several instances. Such instances include the Meuse Valley disaster in Belgium in 1930 when about thirty people died and hundreds were made ill; the Donora incident in October 1948, where twenty persons died and 5,910 (42.7% of the population) were reported to have been affected; the Poza Rica episode where twenty-two persons died and 320 were hospitalized; and the occasional eye, nose and throat irritation in the Los Angeles area. The chronic effects of common and usual air pollution (excluding air borne disease of biological etiology and of plant origin) on the health of exposed persons is a moot question indeed.

The effect of excessive atmospheric pollutants, especially sulfur dioxide, on vegetation is now well recognized. Outstanding examples of vegetation destruction by sulfur dioxide are the areas surrounding the smelters at Ducktown, Tenn., Anaconda, Mont., Salt Lake City, Utah, and Trail, British Columbia. The problem at Ducktown was settled in the U. S. Supreme Court and that at Trail, B. C. before an International Joint Boundary Commission and later before an International Tribunal at which time damages amounting to $78,000 were awarded.

The effect of atmospheric pollution on animals appears to be of two types (1) the direct effect of the pollutants on the animals, and (2) the indirect effect on certain animals from eating contaminated vegitation. Of these, the latter type seems to be of greater importance, evidence indicating a direct effect being very meager at present.

In closing the author stresses some well-known facts, namely, that air pollution control is a matter of engineering, education and equipment. Of these education probably is of the greatest immediate importance. If the people in an enlightened country such as this are given the unvarnished facts, they will recognize (1) that a certain amount of air pollution is the price that must be paid for those many conveniences which are the product of an industrial giant, and (2) that this condition requires a long time to correct—it cannot be done overnight. *ASME Paper No. 52-A-70.*

To get complete text of any paper, follow ordering directions on p 156

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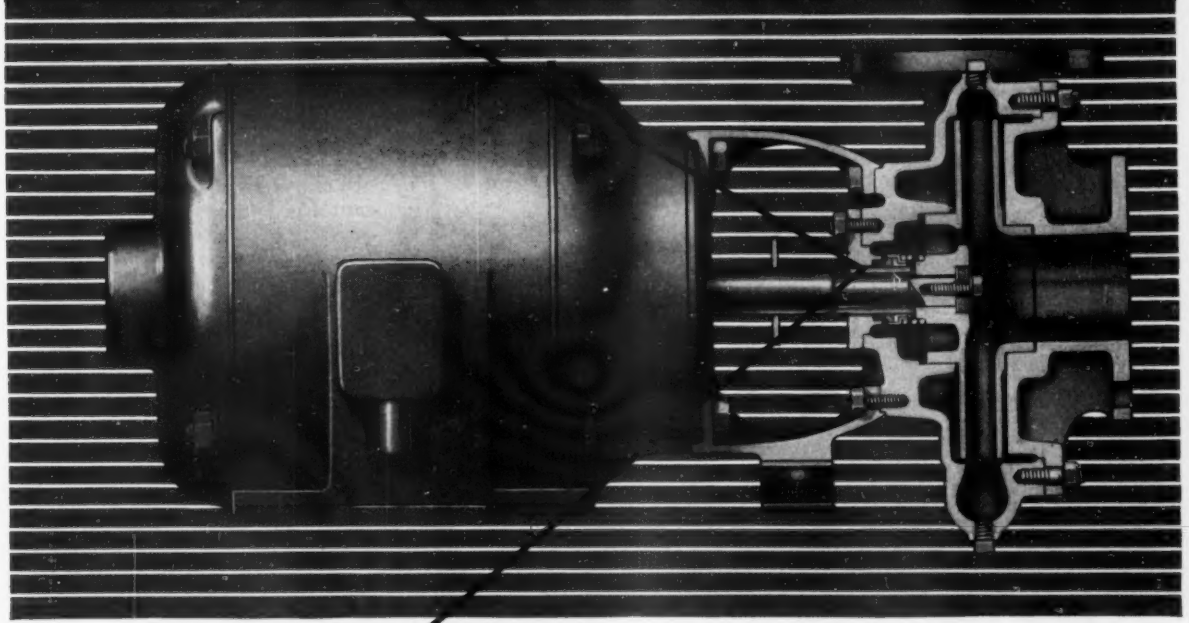

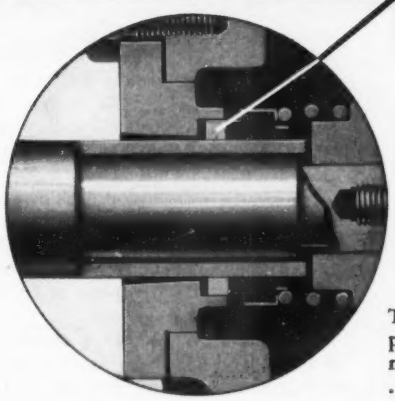

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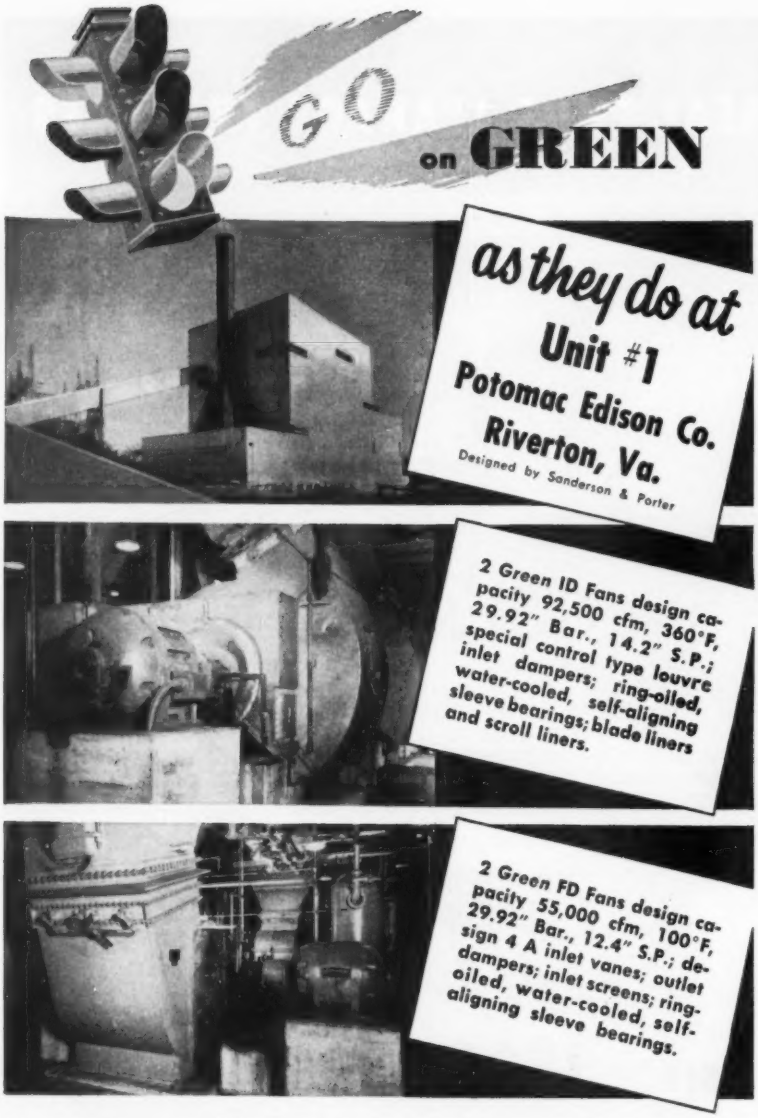
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More POWER NEWS

Begins on page 152

perienced in the latter part of the year. The Bonneville Power Administration of the Federal Government in that region operates under a "calculated risk" policy whereby it contracts to sell power to large industries beyond the firm generating capacity of its hydroelectric plants in dry years, a policy which contemplates the risk of periodic power shortages. In the Tennessee Valley area, drought also resulted in some interruption of power supply to those industrial customers holding interruptible power contracts.

The gross margin between generating capability and peak power demand in 1952 for the country as a whole was the same as it was a year ago, about 12 per cent. Shortage of critical materials, aggravated by the steel strike in mid-summer held back the construction program of the power industry and is expected to continue to affect adversely construction progress in 1953 and 1954. Schedules which called for an addition of 9 million kilowatts of generating capacity in 1952 experienced a slippage of nearly 3 million kilowatts, almost one-third. The actual addition of new capacity was a little over 6 million kilowatts. The causes of delay, however, held back about equally the operations of power consumers so that the anticipated growth of power demand fell short of expectations, leaving the margin between total generating capability and total peak demand unchanged from the year before.

The growth in December peak demand for 1952 was about 7 per cent compared with a growth of 9 per cent in 1951, and in 1950, following the outbreak of the Korean War, an increase of 14 per cent over the previous year.

Total installed generating capability at the end of 1952 was approximately 84.5 million kilowatts. The margin between peak demand and generating capability was about 9 million kilowatts.

The construction program for the entire power industry for 1953 calls for the addition of 12 million kilowatts. Delays in construction schedules are expected to continue, however, because of the effect which shortages of critical materials have already had and will continue to have on the manufacture and installation of heavy power equipment.

Oak Ridge School of Reactor Technology. Application for admission to the 1953-54 session of Oak Ridge School of Reactor Technology must be submitted to the school not later than March 1. This session, the fourth formal class, will begin in September, 1953. Admission is open to recent graduates and to sponsored students

"Is new American cost-cutting weapon... Pure Oil Industrial Lubricants"

Pure Oil specializes in top-quality industrial oils and greases designed to do several *different* jobs—instead of one specific job.

And to do each job *equally well.*

Regardless of the type of machinery you have in your plant, our industrial engineers can nearly always help you to reduce your lubricants inventory . . . simplify your lubricating procedure . . . minimize waste and error.

Mail coupon today for free "Simplify and Save" booklet giving full details on how to start a labor-saving, money-saving, lubrication program in your plant.

Hundreds of machines . . . only one grease!

A large midwestern metal-working plant produces chrome-plated trim (hub caps, grills, etc.) for the automotive industry. All types of metal-working equipment—400-ton presses, shears, drills, lathes, roller-levelers and grinders—are used as well as huge chrome-plating machines. Yet *only one grease*—Pure Oil's POCO HT GREASE B—and one dispenser is used for *all* applications! And in 3 years there has been no down time due to lubrication failures.

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OIL PUMPING
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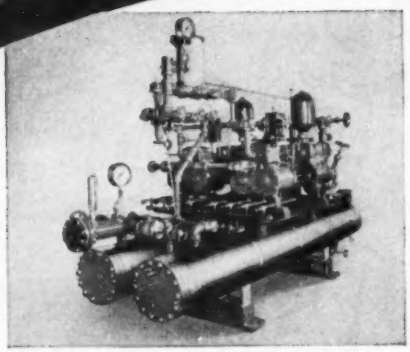
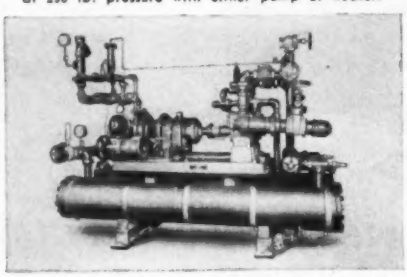
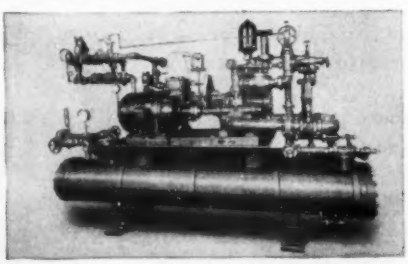


Two Horizontal Duplex Piston Type Steam Pumps and two fuel oil heaters—capacity 15 G. P. H. at 250 lb. pressure with either pump or heater.



One Turbine and One Motor Driven Pump and two fuel oil heaters. Capacity 30 G. P. H. at 150 lb. pressure with either pump or heater.



One Horizontal Duplex Piston Type Steam Pump and one Motor Driven Pump and two fuel oil heaters. Capacity 20 G. P. H. at 300 lb. pressure with either pump or heater.

Every detail part of an Enco Automatic Oil-Heating-and-Pumping Unit System is designed, assembled, checked and tested to make sure that it functions as an element of a completely coordinated unit. The sizes of pipes, fittings, valves and other elements are correctly proportioned for the efficient, dependable operation of the unit as a whole. All hand controls are visible and within reach of the operator for quick starting, stopping or cross-over reconnections between duplicate heaters and pumps. Adjustments and cleaning are similarly simplified.

Single or duplicate heaters and electric or steam-driven pumps are used. Interconnected duplicate units give full capacity with either pump or either heater. Capacities range from 100 to 5000 G. P. H. of heavy bunker oil.

BULLETINS ON REQUEST

OB-37 On oil burning, pumping and heating equipment.

CB-38 Instruction book on care and operation of oil-burner installations.

THE ENGINEER COMPANY
75 WEST STREET Enco NEW YORK 6, N.Y.

More POWER NEWS

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from industry and from government agencies. The objective of the school is to provide a source of the uniquely trained technical personnel required for the AEC's reactor development program by training selected university graduates who join various government agencies and atomic energy contractors as regular employees at the end of the training period. The school also supplements the training of practicing engineers and scientists from industry to enable them to participate, through their sponsoring organizations, in atomic energy development work.

Over 11 million barrels of diesel fuel per month are produced by refineries in the United States, according to a report of the third annual diesel fuel survey prepared by the Bureau of Mines and released by Secretary of the Interior Oscar L. Chapman. The survey, conducted by the Bureau in co-operation with the American Petroleum Institute, covered 285 samples of diesel fuel manufactured in 106 petroleum refineries throughout the country. The Bureau's report contains 16 tables and one illustration, showing the geographic areas covered in the 1952 survey.

A free copy of Report of Investigations 4935, "National Annual Diesel-Fuel Survey, 1952," may be obtained from the Bureau of Mines, Publications Distribution Section, 4800 Forbes Street, Pittsburgh 13, Pa. It should be identified by number, PN 32359, and title.

Please Pass the Condensate is a new 20-minute color and sound motion picture prepared by the **Yarnall-Waring Co** on the subject of up-to-date steam trapping for more production. It portrays the operation, selection, application and maintenance of steam traps all with the ultimate aim of getting more production from steam heated equipment through reduced heat-up time and hotter operating temperature, as well as shortened down-time for repairs and cleaning. Information on obtaining prints for showing may be secured by writing the Yarnall-Waring Co, Philadelphia 18, Pa.

Embodying a new approach in movie filming, a new 30 minute Rust-Oleum color-sound film, *The Captain's Idea* includes a lighthearted, fast-moving plot and scenario with a complete cast of talent and thousands of miles of filming on actual location. Subtly woven into a new version of boy gets girl, the film moves through interesting scenes showing new Rust-Oleum ways to stop rust and cut costs in the petroleum field, railroading, farming, coal mining, steel producers, cement companies, breweries, trucking companies, marine uses, and many more. For complete information write on your letterhead to the Rust-Oleum Corp, 2425 Oakton Street, Evanston, Illinois.

Nuclear power plants on a production line basis are a long way from reality. However, the fact that **Westinghouse** has

TWO TERRY TURBINES IN RECORD NON-STOP RUN AT CITIES SERVICE

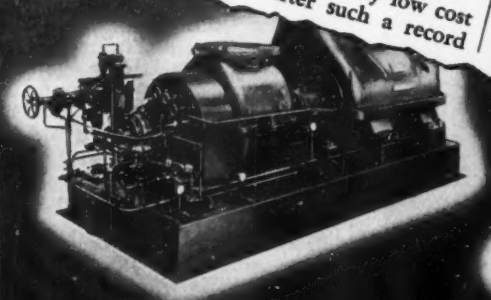
After 26 Months of Continuous Operation, Cost of Replacement Parts Only $78.00 for Each Turbine

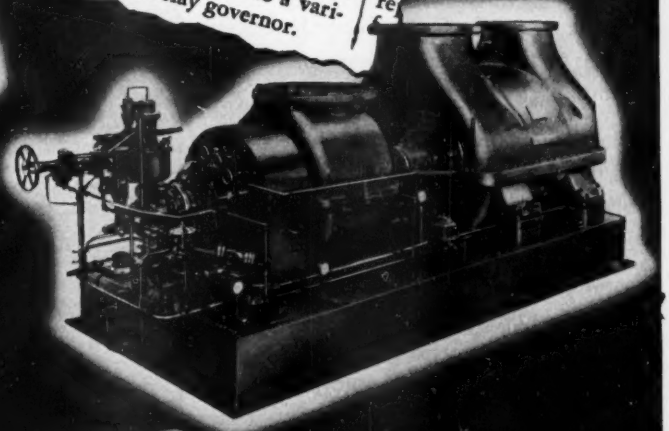
Two Terry turbines recently completed a record non-stop run at the East Chicago refinery of Cities Service Oil Company. Specially designed for driving air blowers on fluid catalytic cracking, they ran continuously *from initial start up*, day and night, for two years and two months. Throughout the entire run neither turbine suffered any noticeable reduction in efficiency.

On inspection, after shutdown, it was found that the only parts showing signs of wear were the shaft packing rings. These were replaced at a total cost of $78.00 for each turbine.

While this extremely low cost for repairs, after such a record run, could not have been anticipated, Cities Service had good reason to expect outstanding performance from Terry turbines. A four-year record of 216 Terry turbines at the Lake Charles refinery of this same company showed amazingly low maintenance costs. During this period, the yearly cost of replacement parts averaged only 1.4% of the initial investment.

The two turbines at East Chicago are rated 2450 horsepower at 5030 rpm. Each is equipped with a trip throttle valve, forced feed lubrication, and regulator for process control applied to a variable speed oil relay governor.



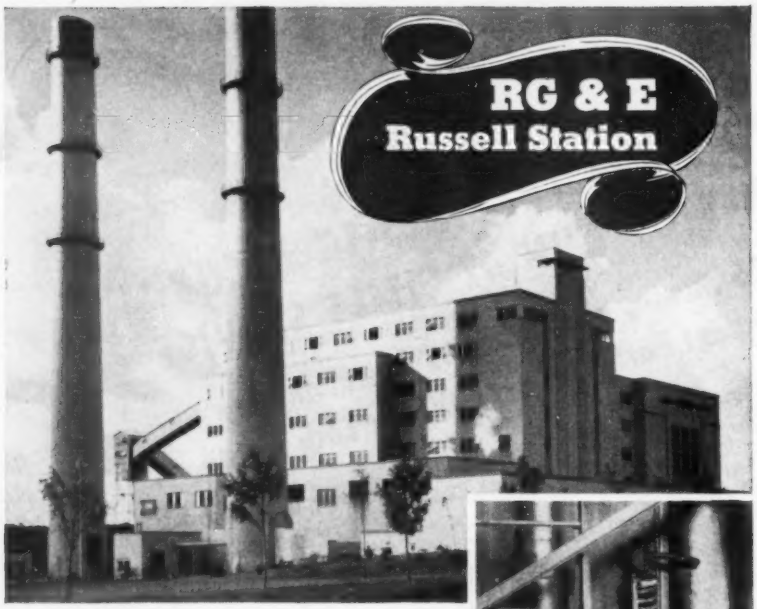


For more information about Terry multistage turbines, send for a copy of Bulletin S-146. No cost or obligation.

TERRY

THE TERRY STEAM TURBINE CO.
TERRY SQUARE, HARTFORD 1, CONN.

TT-1193



Safety Valve Report:

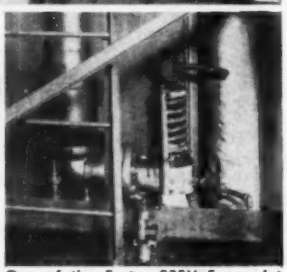
- **"2 YEARS IN SERVICE...**
- **NO MAINTENANCE...**
  STILL TIGHT!"

That's the report from Rochester Gas & Electric Co. on the Foster Super Jet Safety Valves on the #2 unit of their new Russell Station.

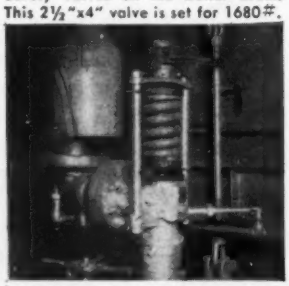
Other points they like about these valves are their greater capacity, so that fewer valves are necessary, and their accessibility for inspection and service.

Foster Super Jet Safety Valves give better protection two ways: absolute protection against overpressure, and greater protection against costly outages caused by service failures.

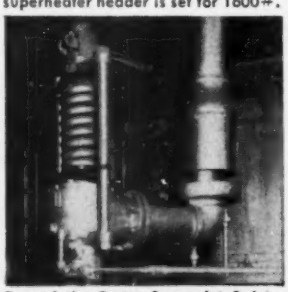
For full information on Foster Super Jet Safety Valves, ask for Bulletin 80-SV.



One of the Foster 38SV Super Jet Safety Valves on the boiler drum. This 2½"x4" valve is set for 1680#.



This 2½"x4" Foster Super Jet on the superheater header is set for 1600#.



One of the Foster Super Jet Safety Valves on the reheater inlet header. This 4"x6" valve is set for 530#.

PRESSURE REGULATORS • RELIEF AND BACK PRESSURE VALVES • CUSHION CHECK VALVES • FAN ENGINE REGULATORS • PUMP GOVERNORS • TEMPERATURE REGULATORS • FLOAT AND LEVER BALANCED VALVES • NON-RETURN VALVES • VACUUM REGULATORS OR BREAKERS • STRAINERS • SIRENS • SAFETY VALVES • FLOW TUBES

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More POWER NEWS

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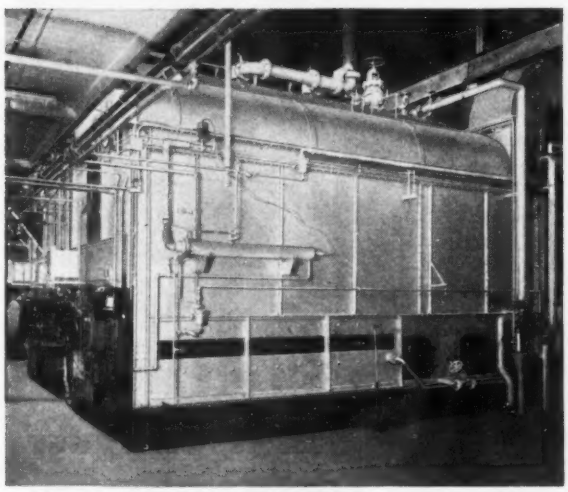
under construction or design three of these plants of major size gives some definition about the present status of the science of controlled nuclear energy. One of these nuclear power plants is a prototype that could be installed in a submarine. It is a full-size working model of the submarine atomic plant located at the National Reactor Testing Station near Arco, Idaho. The second plant is known as Mark II, and manufacture has been started on many of the components. The submarine Nautilus, for which the keel was laid by the Electric Boat Co last July, will be the first submarine to receive this revolutionary new type of power plant. In the reactors for Mark I and Mark II, water is both the moderator and the primary coolant fluid. In the Nautilus, nuclear energy will be put to use for large-scale control-power utilization for the first time. This will result in an around-the-world submarine. The third project concerns the design and development of another nuclear power plant many times larger than those mentioned above. It is planned that this power plant shall be suitable to power major naval vessels, such as aircraft carriers. However, it could well be a forerunner of the reactors which someday can be used to produce useful power, including electricity for homes and industry.

A 36,000-hp wound-rotor electric motor, one of the world's largest, has been installed in the Boeing Airplane Co wind tunnel at Seattle. Custom-built by **Westinghouse Electric Corp,** the new motor will be used in conjunction with the tunnel's original 18,000-hp motor, giving Boeing the most powerful privately-owned wind tunnel in the world. It stands 13 ft high, weighs 225,000 lb and will operate at 480 rpm, with a clearance of .09 in. between rotor and stator.

Delayed delivery of three carloads of generator parts for the Detroit Dam (Ore.) hydro-powerhouse has postponed the operation date of the Willamette Valley project unit. The generating plant was scheduled to start turning out power for the Bonneville Power Administration system by Jan. 1. But the delay, according to Harry Rutherford, project engineer, means it will require most of the winter to assemble the parts and place generators in operation. Detroit Dam will have a peak output of 100,000 kw. The Big Cliff Dam and powerhouse, 3 mi downstream, are slated to generate a constant 18,000 kw.

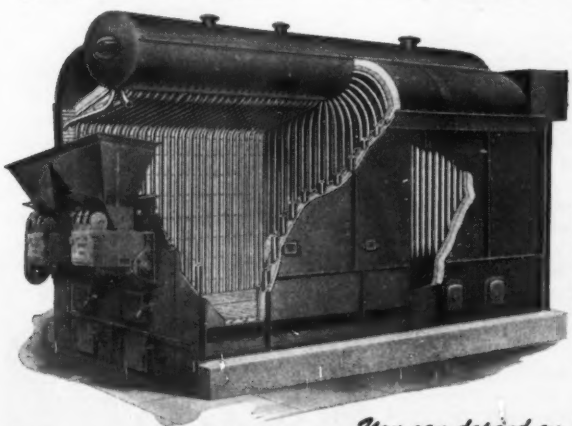
Electric power from the Aqueduct and Owens Gorge hydroelectric plants of the Los Angeles Department of Water and Power started flowing into the west San Fernando Valley December 15, in time to avert a threatened power shortage in the area this winter. Initial operation of the line will supply the West Valley area with an additional 35,000 kilowatts of power, vitally needed by the fast growing area where electric demands have more than tripled in the past 10 years.

3 Erie City VL's Pay Off in 18 Months at Kaiser-Frazer



Above: Battery of 3 Erie City "VL's"—oil and gas fired—that replaced 7 obsolete coal fired units at a Detroit plant of Kaiser-Frazer Corporation.

Below: Sectional view of standard factory-assembled Erie City "VL" boiler with Erie City spreader stoker. Available for all firing methods.



Before modernization of the E. Jefferson Avenue Detroit plant of Kaiser-Frazer, seven coal fired boilers dating from 1911 and 1920 were in service. The new power plant consists of 3—20,000 pounds per hour Erie City "VL's" for oil and gas firing. They supply steam for heating and process.

While the cost of steam, using coal, would be about 5 cents less per thousand pounds, the use of oil and gas reduced capital investment due to the elimination of new coal storage and allied equipment. Average boiler efficiency of the 3 new Erie City "VL" boilers is 81.5%. Power house labor was reduced from 14 to 6 men. The combined savings from greater efficiency, minimum maintenance and reduced labor costs is expected to pay for the new boiler installation in 18 months.

Are you wasting fuel dollars with worn out boilers? Let Erie City Engineers recommend steam generators that will pay for themselves out of savings.

20 Page Catalog describing Erie City "VL's" in detail shows its easy adaptability to all firing methods and illustrates its superior design features. "VL's" are factory assembled to 300 hp. and field erected in larger sizes. Ask for Bulletin SB-43.

You can depend on Erie City for sound engineering

ERIE CITY
112 Years in Steam Generation

ERIE CITY IRON WORKS • Erie, Pa.

STEAM GENERATORS • SUPERHEATERS • ECONOMIZERS • AIR PREHEATERS
UNDERFEED AND SPREADER STOKERS • PULVERIZERS

"THIS LUBRICANT SAVED US $2,098·16 IN SEVEN MONTHS"

—says THE BROWN COMPANY
Quality Paper Makers of Berlin, N. H.

"During a seven-month period before using LUBRIPLATE No. 130-AA in the bearing of our Kraft Mill Lime Kiln, we used a conventional oil at a cost of $2,134.00. In the seven months that followed, we used LUBRIPLATE No. 130-AA for initial filling and replacement at the cost of $35.84."

For nearest LUBRIPLATE distributor, see Classified Telephone Directory. Send for free 56-page "LUBRIPLATE DATA BOOK"... a valuable treatise on lubrication. Write LUBRIPLATE DIVISION, Fiske Brothers Refining Co., Newark 5, N. J. or Toledo 5, Ohio.

REGARDLESS OF THE SIZE AND TYPE OF YOUR MACHINERY, LUBRIPLATE LUBRICANTS WILL IMPROVE ITS OPERATION AND REDUCE MAINTENANCE COSTS.

BOOKSHELF

Federation of British Industries' Register of British Manufacturers. *(1952-'53). (25th edition). 922 pp, 7½x9½ in., cloth. 42s. 0d. (post free). Iliffe & Sons, Ltd, Dorset House, Stamford St, London, SE 1, Eng.*

This is the only authorized directory of the Federation of British Industries and is recognized as a standard export reference book to British industry. The Register comprises seven sections, including products and services, a classified buyer's guide listing over 6000 FBI member firms under more than 5000 alphabetical trade headings. The introductory information and detailed instructions on the use of the Register are translated into French and Spanish, and all sections have reinforced guide cards for easy reference.

Other sections of the Register include the: Advertisements Section, Addresses Section, Trade Associations, Brands and Trade Names, Trade Marks.

The British Electrical & Allied Manufacturers' Association, Inc, Catalogue. *(1952-'53). (Second edition). 1003 pp, 9x12 in., illust, cloth, (price not given). Iliffe & Sons, Ltd, Dorset House, Stamford St, London, SE 1, England.*

The Catalogue is divided into eight sections, each marked by a stiff index card for convenience. All directions are translated into German, French, Spanish and Portuguese. The sections include separate directories of manufacturers of equipment for (1) power plant, (2) industry, transportation and communication, (3) domestic and commercial buyers. Other sections include (4) glossary and index, (5) buyer's guide, (6) trade directory, and (7) catalogue index.

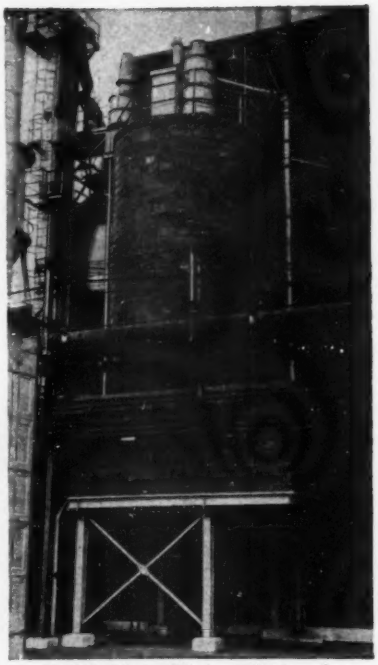
Robert Moses: Builder for Democracy. *(1952) By Cleveland Rodgers. 356 pp, 5½x 8½ in., photos, maps, cloth, $6.00. Henry Holt and Co, 383 Madison Ave, New York 17, N. Y.*

To New Yorkers, the name of Bob Moses is a household word. They drive his parkways, cross his bridges, enjoy his parks and know him for a public servant of enormous accomplishment. Among builders and city planners he has a worldwide reputation for his ideas and his knack for efficiently bringing them to reality.

Cleveland Rodgers' story of what Bob Moses has done and how he did it makes interesting reading for engineers for, perhaps more than any other man in public life, he has been able to translate the work of engineers and builders into lasting benefits to the citizens of his city and state.

An Introduction to Scientific Research. *(1952) By E Bright Wilson, Theodore William Richards, Professor of Chemistry, Harvard University. 375 pp, 6x9 in., illust, cloth, $6.00. McGraw-Hill Book Co, 330 West 42nd St, New York 36, N. Y.*

At some time or another, nearly every engineer runs into a problem to which only research can supply the answer. Actually such situations occur fairly frequently in



A "National" installation for American Cyanamid Co. plant at Bridgeville, Pa.

ASH REMOVAL the NATIONAL way assures you low-cost, dependable service

Are ash removal costs a factor in cutting your profits? We suggest a survey by a National engineer. It will cost you nothing. It may avoid wasted dollars.

NATIONAL PNEUMATIC STEAM ASH REMOVAL SYSTEMS

save money in two ways—

1. Exceptionally easy one-man operation cuts labor cost to the bone.
2. Maintenance costs are surprisingly *low* because rugged NATIONAL construction results in maximum life for parts.

A complete and effective service policy and a reputation for delivering satisfaction are extras that go with NATIONAL installations.

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Manufacturers of The National ChipVeyor System For Metal Turnings—Furnace Doors—Feeders—Ash Gates and Related Equipment.

ACCURACY

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Just as the champion bowler maintains *top* control when he chalks up a "strike", the Leslie team wraps up perfect performance in LESLIE Temperature Regulators.

There's a LESLIE Regulator for every temperature control problem—designed to meet the demand for accurate, reliable, constant temperature regulation.

It will pay to explore the advantages of—

TRADE LESLIE MARK

- **Single Seated Construction**
- **Calibrated Dial Adjustment**
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- **Liquid Filled Elements**
- **Other Leslie Features**

All described in Bulletin 464, available on request.

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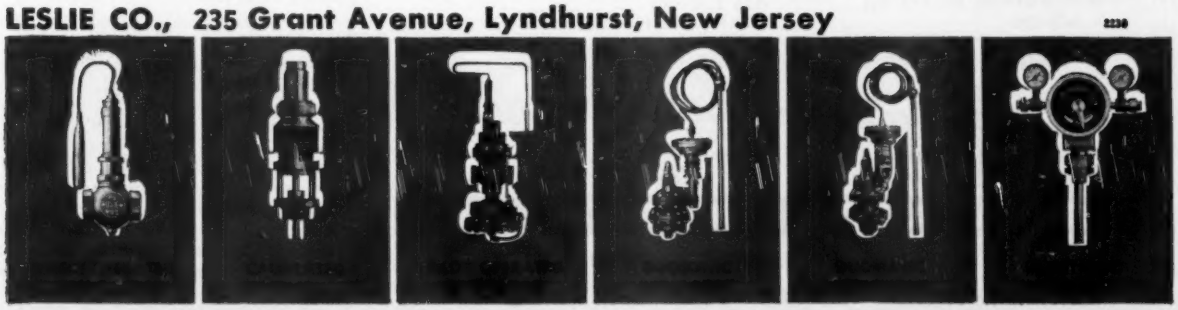

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STEAM and MECHANICAL ATOMIZATION

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PATENT PENDING

NATIONAL AIROIL
DUAL STAGE
OIL BURNER

Now, at last, the inherent advantages of *both* systems of fuel oil atomization are *profitably* yours . . . within the one, new NATIONAL AIROIL Dual Stage Burner.

41 years of combustion equipment design and manufacture are in back of the Dual Stage Oil Burner . . . and, it has been thoroughly tested and proved in the field for firing: Petroleum Processing Heaters; Rotary Kilns; H.R.T., Scotch Marine and Water Tube Boilers; etc.

Available in three sizes, the NATIONAL AIROIL Dual Stage Burner fires all grades of fuel oil from No. 2 to No. 6, with a ready capacity of 80 to 300 g.p.h. Further, for a perfect flame pattern, we would recommend using with the Dual Stage Burner either the NATIONAL AIROIL Universal Register for forced draft or, the NATIONAL AIROIL Tandem Unit for natural or induced draft furnaces.

Get detailed description, illustration, and specifications in NATIONAL AIROIL Bulletin 25.

STEAM ATOMIZING OIL BURNERS
OIL BURNERS and GAS BURNERS for industrial power, process and heating purposes
MOTOR-DRIVEN ROTARY OIL BURNERS
MECHANICAL PRESSURE ATOMIZING OIL BURNERS
LOW AIR PRESSURE OIL BURNERS
AUTOMATIC OIL BURNERS, for small process furnaces and heating plants
GAS BURNERS
COMBINATION GAS & OIL BURNERS
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INDUSTRIAL OIL BURNERS, GAS BURNERS, FURNACE EQUIPMENT

More BOOKSHELF

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practice although the engineer may not think of the way he finds the answer as being *research*. Thus engineers will find much helpful information in this book, although it was written for students and graduates beginning a career in research.

In a practical fashion, the author discusses the general principles of research investigations, the methods employed and the analysis of experimental results.

Typical chapters cover: searching the literature, elementary scientific method, designing experiments and apparatus, analysis of experimental data, errors of measurement, probability, numerical computation methods, and reporting test results.

Fundamentals of Engineering Electronics. (*Second edition*). *By William G Dow, Professor of Electrical Engineering, University of Michigan. 6x9 in., 627 pp, $8.50. John Wiley & Sons, Inc, 440 Fourth Avenue, New York 16, N. Y.*

As with the first edition, this book is aimed for the student of electrical engineering, particularly those planning a life work in electronic circuit engineering. Although primarily a textbook, it should also be useful as a reference book for electron tube and electron circuit engineers.

The book covers Electron Ballistics; Potential Distribution Diagrams; Cathode Ray Devices; Electrostatic Fields in Space-Charge Control Tubes: Triodes, Tetrodes, and Pentodes; Thermionic Cathodes; Amplifier Control Principles; Photosensitive Devices; Gaseous-Conduction Rectifying Devices, to list but a portion of the contents. There is a liberal but needed use of mathematics throughout.

In comparing with the first edition the following changes are noted: The mks (meter-kilogram-second) system of units is used throughout. This ties in with accepted modern engineering practice. Equivalent electrostatic circuits and equivalent grid sheet potential concepts are included in the analysis of space-charge-control tubes.

Thermodynamic Properties of Nitrogen. *Research Bulletin 18. October 1952. 28 pp, 8½x11 in., paper, $3.50. Institute of Gas Technology, Technology Center, Chicago 16, Ill.*

This bulletin, by O T Bloomer and K N Rao, presents the properties of saturated and superheated nitrogen in tabular form and as charts of enthalpy vs entropy, and of compressibility factor as a function of temperature and pressure. The range of the tables and charts is from saturated liquid at —320.4 F to superheated vapor at 500 F, and pressures from 10 to 1500 psia. Properties tabulated are specific volume, enthalpy, entropy, and the fugacity-to-pressure ratio. For the superheated vapor region, calculations were based on zero-pressure specific heat data and a new equation of state. Calculation construction and the development of the equation of state are fully discussed.

As a supplement to the bulletin, the *Mollier Chart for Nitrogen* and *Compressibility Chart for Nitrogen* have been reproduced full scale (grid 10x10 to the inch) on heavy paper, 22x34 in. They are issued as a set only, and are sold separately.

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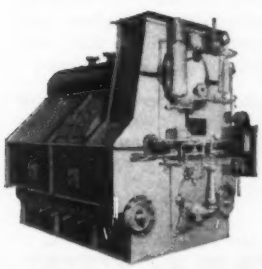
insures careful planning and prompt production of your boiler installation

When you need steam generating equipment, you want to be able to work out your requirements with experienced men who are near at hand and know boilers thoroughly. That's where WICKES can help you, because WICKES has factory-trained sales engineers in twenty-three principal cities in the United States and several industrial centers outside the country. These men are ready to help you plan your new boiler installation.

And when your plans are settled, you want your equipment installed as soon as possible. That's when WICKES engineers and production men swing into action. They rush to get your new boiler installation ready in a hurry. WICKES handles all the details—from the time the first drawings are made to the day you raise steam pressure. Then, for the life of the boiler, WICKES sales engineers and maintenance men are available day and night to keep your equipment operating at peak efficiency.

WICKES can fill your requirements for steam generators up to 250,000 lbs. per hour and 1000 psi.—all types of multiple drum boilers, adaptable to any standard method of firing. Write today for descriptive literature or consult your nearest WICKES representative.



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146

TWO STAGE — DOUBLE ADJUSTMENT

Crusher is pictured without hopper and sprocket guards, but is delivered complete.

WRITE TODAY FOR CRUSHER BULLETIN P-3

Two Stage CRUSHING IN ONE MACHINE!

The GUNDLACH "Two Stage" Coal Crusher incorporates two crushing stages in one machine and is designed to reduce RUN-OF-MINE to STOKER COAL in ONE operation. Compact design simplifies structural supports and installation. Rugged simple construction combined with engineering proved in the field makes this machine a profitable and reliable unit.

Fulfilling an urgent need in the industry, the GUNDLACH "Two Stage" Crusher has delivered over 85% usable stoker coal from an Illinois mine run lot

All Gundlach Crushers are equipped with Gundlach Patented Crushing rollers. (Pat. No. 2578540)

MATERIAL SIZE CAN BE CHANGED WHILE MACHINE IS RUNNING

T. J. GUNDLACH Machine Co., Belleville, Ill.

My Biggest Boner

► I'M NOT PROUD of this sad tale but it taught me and several other men a lesson, so here goes.

We hired three new firemen in our plant awhile back. All had long experience on pulverized-coal and gas-fired boilers but had never run oil-burning units. So they were told to report to me for some instruction on right firing methods.

I showed them around the boiler room, explaining the right way to light off a burner. I went through all the steps of recirculating oil, inserting the atomizer, purging the furnace, lighting the torch and inserting it.

Asking if they had it clearly in mind, I stepped back, lit a torch, closed the recirculating valve and quickly opened the oil control valve.

I started to say, "This is the way to light off" when a solid, hot stream of No. 6 oil at 300 psi hit me smack in the middle of the stomach. It sprayed all over the boiler room floor and part of the wall behind me, ruining the chief's latest paint job.

When I finally turned the oil off it took me an hour to get it out of my hair, eyebrows and skin. But one thing those three grinning firemen and I learned was to make sure the burner is in place before lighting off.

W C RITCHIE

Newman, Calif.

● What is your "biggest boner"? We'll pay ten dollars for each one we publish.

Pacific Gas & Electric Co has filed new applications with the Federal Power Commission for hydroelectric developments on the Feather River. The company plans a $114 million development on the North Fork of the river including two diversion dams and four power plants, generating a total of 364,000 kw. PG&E already has six plants on the river generating 387,000 k.w.

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IF you are responsible for the efficient operation of air conditioning equipment, send for a FREE copy of this handy little booklet.

It tells you what to do about lime scale. How to get rid of it. How to prevent it from forming. And the booklet discusses that other enemy of efficiency . . . slime. Describes simple, low-cost ways to prevent it from fouling up lines, tanks and spray jets.

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Another Station in NIAGARA MOHAWK'S *System*

ALBANY STEAM STATION
Two units of 100,000 kw each are already in operation, a third is under construction and foundation for a fourth unit is underway

Albany Steam Station, on the west bank of the Hudson River at Albany, New York, serves the eastern part of New York State primarily and is an integral part of the Niagara Mohawk power network.

Designed by the engineering department of Niagara Mohawk Power Corporation with construction supervision by Stone & Webster Engineering Corporation.

STONE & WEBSTER ENGINEERING CORPORATION

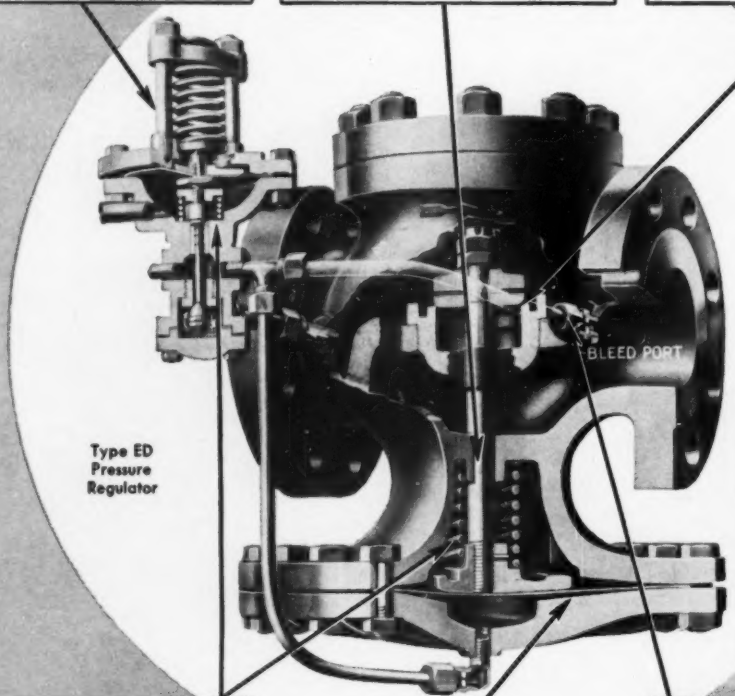
A SUBSIDIARY *of* STONE & WEBSTER, INC.

ONLY SPENCE REGULATORS ...give you all these design advantages

Separate Interchangeable Pilot . . .
controls main valve . . . simplifies inspection and maintenance.

Packless Construction . . .
minimizes friction . . . improves control accuracy and eliminates much time-consuming maintenance.

SECO Metal Seats and Discs . . .
resist wiredrawing. More than 20 years of experience has failed to produce a single case where SECO Metal was cut by steam.



Type ED Pressure Regulator

Dead-End Shutoff . . .
guaranteed on steam service when a balanced, single-seated main valve is equipped with SECO Metal seat and disc and is protected by an approved strainer.

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out of path of steam or other fluid flowing through the valve. They operate at low unit stress for exceptionally long life.

Large Balanced Metal Diaphragms . . .
located in a cooled zone with a condensate seal above and below, under usual conditions, never need replacement.

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quick access to all vital elements of regulator. No special tools needed.

These Spence design features explain why Spence Regulators function dependably and accurately year after year, without requiring extensive repairs or special attention. This lowers over-all costs . . . means less down-time of the system. • Spence makes a complete line of automatic regulating valves: pressure reducing, differential pressure, back pressure control, pump governor, temperature regulating and other types. Write for Bulletin giving full details.

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SE 122

Straight Tube
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Condensing
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Desuperheating
High Pressure
Low Pressure
Large Capacity
Small Capacity

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the right feedwater heater design for your needs

No matter what may be your capacity needs, your boiler pressure, your plant heat balance, or your special operating conditions, you can be sure that G-R can supply a practical, effective design of feedwater heater precisely suited to your needs.

That's because of the 65 years of G-R experience in building feedwater heaters, throughout which the G-R designs have been steadily developed to keep abreast of advances in steam plant practice.

And here's another important result of this unequalled G-R experience . . . the many proven exclusive design features that assure long, economical service as well as highly efficient heat transfer.

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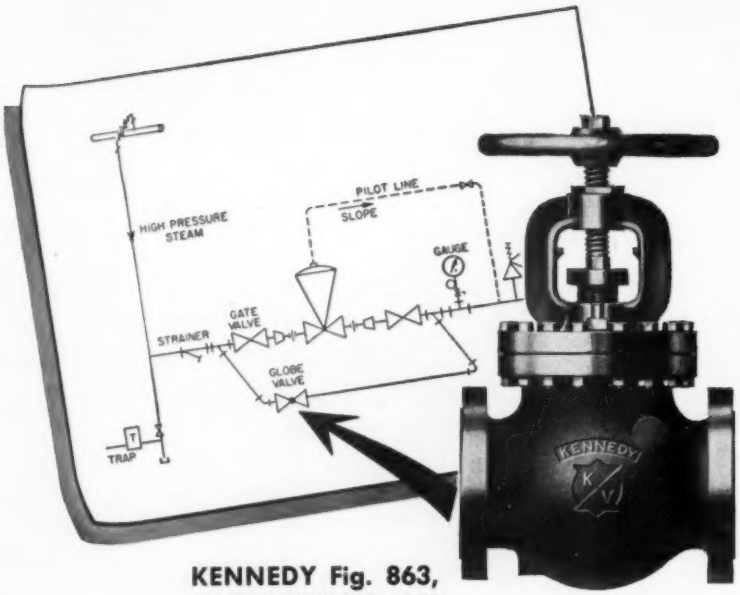
G-R HEAT TRANSFER APPARATUS *Feedwater Heaters*



KENNEDY Fig. 863,
Iron-Body Globe Valve. 250 pounds of steam at 500°F.

Here's how to set up pressure-reducing lines for easier maintenance

You naturally don't want to shut down a vital part of your operation when you repair a single valve.

You can avoid doing so by installing a by-pass around your pressure-reducing valve and installing a globe valve in the by-pass line. With this set-up you can use the globe valve for hand throttling when the reducing valve is removed from the line for repairs.

KENNEDY JOB-FITTED IRON-BODY GLOBE VALVES are designed and constructed for high pressures and severe service on steam or water lines and for heavy-duty service with oil, gas and other fluids that do not corrode bronze or iron.

Individual valves in the KENNEDY JOB-FITTED line are specially designed with the proper disc and seat trim to match the service for which they are recommended. Valves with either renewable composition or bronze faced discs are available, depending on the pressure in the line.

REPACK UNDER PRESSURE—You can repack ALL KENNEDY iron-body globe valves under full line pressure when wide open.

THE COMPLETE LINE of KENNEDY JOB-FITTED valves and INSPECTED fittings is sold through local distributors who are in a position to give you fast and convenient service.

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Begins on page 167

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17 TIME-CYCLE CONTROLS — Impulse-sequence time-cycle controllers. Cutaway drawings, illust. 12 pages. Bulletin C305. The Bristol Co, Waterbury 20, Conn.

MECHANICAL CONTROLS

18 CONDENSED CATALOG—For boiler water feeders, low water cutoffs, pump controls, temperature and pressure relief valves. 8 pages, illust. Bulletin C-49. McDonnell & Miller, Inc, 3500 N Spaulding Ave, Chicago 18, Ill.

19 PNEUMATIC CONTROLLER—Flow rate, differential pressure, liquid level, viscosity, pressure and temperature operations; motion balance controller. 20 pages. Catalog C-50. Fischer & Porter Co, 6890 Jacksonville Rd, Hatboro, Pa.

20 PNEUMATIC CONTROL THERMOMETERS — Construction, engineering details of indicating and recording thermometers with pneumatic control. 4 pages. Spec sheet 612. Minneapolis-Honeywell Regulator Co, Brown Instrmts Div, Sta 64, Wayne & Windrim Aves, Phila. 44, Pa.

21 AIR PRESSURE REGULATORS—For instruments, constant pressure differential regulators. 8 pages, illust. Catalog 29. Fischer & Porter Co, 749 Jacksonville Rd, Hatboro, Pa.

22 CONTROL EQUIPMENT—General catalog of measuring and control equipment for water and sewage, power and processing industries. 28 pages. Catalog 003. Simplex Valve & Meter Co, 68th & Upland Sts, Philadelphia 42, Pa.

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24 DISRUPTOR SWITCH—For 600 volt ac or dc service combines disconnect and load interruptor functions. 4 pages. Bulletin 5208. Delta-Star Electric Div, H K Porter Co, Inc, 2437 Fulton St, Chicago 12, Ill.

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HOW *Carey* HELPS THIS

power plant in the sky

KEEP OPERATING COSTS down to earth

Arapahoe Station, Public Service Company of Colorado

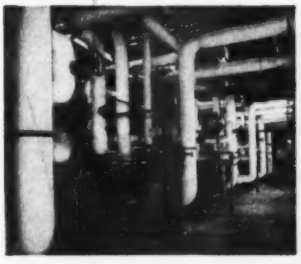
B & B Engineering and Supply Co. Inc., Houston, Texas—Insulation Contractor ● Ebasco Services, Inc., New York City, Design Engineer and General Contractor

At this new 132,000 kw, steam electric generating plant – built at an elevation of over 5200 feet – Carey insulation products conserve heat, save fuel, help satisfy the West's growing appetite for low cost power.

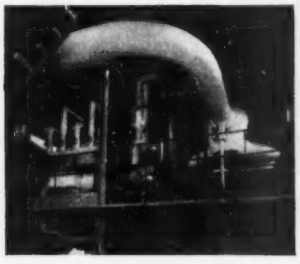
Carey insulation products were chosen for Arapahoe on the strength of their proven ability to meet, economically, all requirements for strength, lightweight, dimensional stability and performance on a wide range of equipment, operating at temperatures to 900° F.

Development and manufacture of products for heat conservation has been an important Carey service to industry since 1873. That's why we believe we can solve *your* heat conservation problem, no matter how unusual it may be. The Carey line includes new, monolithic Super-Light 85% magnesia in molded pipe coverings, blocks and cements – now being manufactured in our new multi-million dollar plant. This material is light-weight, strong, easy to handle, easy to apply. It will not disintegrate or crack under normal service conditions and can be removed and reapplied, when necessary.

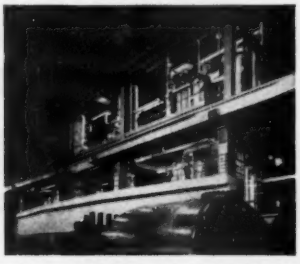
Call on Carey for the solution to your heat conservation problems. Use the coupon to request the latest bulletins describing uses for Carey insulation products. If you wish, the coupon will also enlist for you the services of a qualified Carey Industrial Sales Engineer. No obligation.



● In the boiler feed pump room, feed water discharge lines and recirculating lines are insulated with 2" thick Carey 85% magnesia insulation. Finish is 8 oz. canvas on rosin sized paper. Boiler feed water suction lines insulated with Carey standard thickness 85% magnesia, finished with 8 oz. canvas over rosin sized paper.



● The main steam lines and stop valve to turbine, where operating temperatures reach a maximum of 905° F. 8" and 12" pipe, insulated with 2" thick Carey Hi-Temp and 2" thick Carey 85% magnesia, finished with ½" Carey asbestos cement, layer of asbestos paper, layer of asbestos cloth, sewn on with copper wire.



● View of Arapahoe Station from turbine floor. Elevation 5287'. Workmen are applying 8 oz. canvas to lines.

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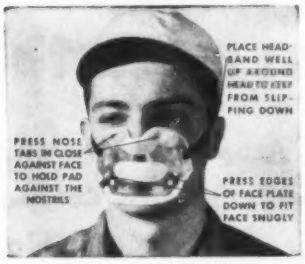
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PRESS NOSE TABS IN CLOSE AGAINST FACE TO HOLD PAD AGAINST THE NOSTRILS
PRESS EDGES OF FACE PLATE DOWN TO FIT FACE SNUGLY

Weigh Less than ½ ounce.

Clean, cool, comfortable. Excellent protection against non-toxic dusts except free silica. Replaceable cotton pads are inexpensive and sanitary.

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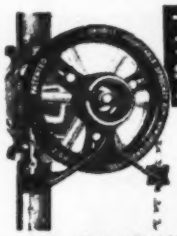
Control Valves from the Floor



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ELIMINATES STEP-LADDER CLIMBING RISKS

● Range of 10 adjustable sizes take care of all valve makes and types; fits valve wheel diameters from 2 to 30 inches.

● Climbing on benches, machines, boilers or treacherous stepladders to control overhead valves is absolutely unnecessary, foolish risking of life and limb. Why permit such risks when the safe and sure BABBITT Adjustable Sprocket Rim with Chain Guide is available at such low cost? Overhead valves are conveniently and safely operated right from the floor!

● The BABBITT Adjustable Rim fits all valves, with either rising or non-rising stems. It is installed quickly by clamping onto the hand wheel of the valve.

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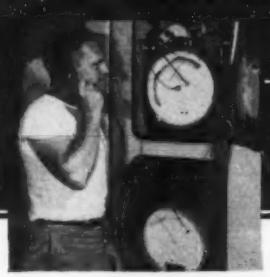

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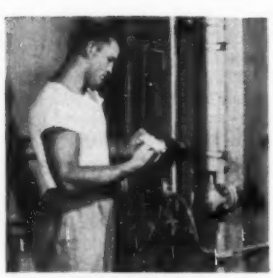

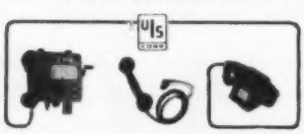

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Remember the legend of Damocles? His tyrant ruler compelled him to sit in the royal court for one day with a naked sword suspended over his head by a single hair.

THE MORAL: There are many "naked swords" hanging over industry's head today too. Perhaps you're a fellow sufferer with Damocles. Your plant may be threatened by damage from overpressure within pressure vessels. Damocles needed a warrior's helmet to save him from his sword . . . he needed a "safety head" tailored to his requirements. Pressure vessels need BS&B Safety Heads tailored to your particular pressure specifications . . . designed to fail safe when overpressure occurs.

BS&B SAFETY HEAD

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Your Best Protection From Overpressure Within Pressure Systems

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Into the rupture disc is built a controlled weakness. It's designed to fail safe within plus or minus 5% of the predetermined pressure specifications. You give us the necessary operating information and BS&B will give you a safety head with an action that is fast, positive and accurate . . . regardless of whether your pressure applications are for air, gas or liquid—bland or corrosive.

First, the metal is selected for fabrication to specifications of any given lot of discs. Then discs are selected at random and tested to destruction after lot is completed. If each one tested does not break within 5% of the rated pressure the entire lot is discarded. Rupture discs are available within range of 5 lbs. to 40,000 lbs.

BS&B Safety Heads can be used for either primary or secondary relief.

Why not remove one of "the swords of Damocles" that may plague you. Write today for complete BS&B Safety Head Catalog and details. There is no charge or obligation for a complete analysis of your pressure safety requirements.

BLACK, SIVALLS & BRYSON, INC.

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SAFETY BS&B HEADS OUR 50TH YEAR

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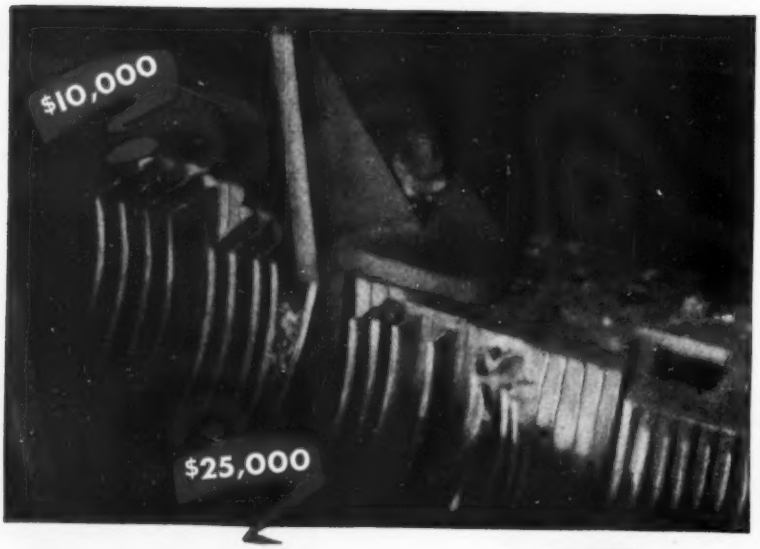
$5,000?



If This Happened to Your TURBINE

$50,000?

● Replacement of turbines is costly . . . even in the case of minor repairs, labor, parts and downtime costs soon mount up. To go under the assumption that the installation of superheaters in a boiler eliminates the need for purifier protection is dangerous. Particularly during startup and periods of faulty boiler operation such as occurred above, all turbines should have Hi-eF Purifier protection. These high efficiency units assure you of the delivery of cleaner, drier steam of better than 99.95% quality.

Write, wire or phone today for information on protecting your steam-using equipment and boilers with Hi-eF Purifier.

ANDERSON Hi-eF PURIFIERS

WATCHDOGS OF STEAM • AIR • GAS • VAPOR
Pipelines and Equipment

THE V. D. ANDERSON COMPANY
1934 W. 96th Street – Cleveland 2, Ohio

Please send information on the following types of purifiers:

☐ Line Type ☐ Internal ☐ Receiver

Name ..... Title .....

Address .....

City .....

State .....

BY THE MAKERS OF SUPER-SILVERTOP STEAM TRAPS

More FREE BULLETINS

Begins on page 167

47 FLOW INDICATORS—Flapper type, sight glass, rotary and ball flow indicators. 12 pages, illust. Bulletin 18W. Schutte & Koerting Co, Cornwall Heights, Bucks County, Pa.

48 FLOW METERS—Evenly graduated flow meters with electronic integration. 24 pages. Catalog 2300. Minneapolis-Honeywell Regulator Co, Brown Instrmts Div, Sta 213, Wayne & Windrim Aves, Philadelphia 44, Pa.

49 RECORDERS, INDICATORS—Information on electronic non-control precision instruments. 44 pages, illust. Catalog 1520. Minneapolis-Honeywell Regulator Co, Brown Instrmts Div, Sta 64, Wayne & Windrim Aves, Philadelphia 44, Pa.

PIPING, VALVES, FITTINGS AND SPECIALTIES

50 SAFETY, RELIEF VALVES—For boilers, air receivers, hydraulic systems, general pressure, etc. Descriptions, specs. 85 pages. Bulletin 800-V. J E Lonergan Co, 2nd & Race Sts, Philadelphia 6, Pa.

51 STEAM TRAPS—Construction details, working position drawings, specs for heavy condenstate straps. 4 pages. Bulletin T-1745. Yarnall-Waring Co, Chestnut Hill, Philadelphia 18, Pa.

52 PIPE THREAD MANUAL—For pipe threads, pipe taps, pipe thread gauges. 24 pages. Manual C-52. Detroit Tap & Tool Co, Detroit, Mich.

53 STEEL TUBES—Seamless and mechanical steel tubes, seamless and welded stainless steel tubes, welding fittings. 12 pages. Bulletin 103-Z. Globe Steel Tubes Co, Milwaukee 46, Wis.

54 VALVES—Maintenance and testing of high pressure, high temperature valves. 16 pages, illust. Vol. 11, No. 39. Edwards Valves, Inc, Rockwell Mfg Co, East Chicago, Indiana.

PRIME MOVERS AND ACCESSORIES

55 RADIAL ENGINES—Design, operation, application of two-cycle diesel, spark-fired gas, dual-fuel engines. 20 pages. Bulletin 200. Nordberg Mfg Co, Milwaukee 1, Wis.

56 ELECTRIC PRE-HEATER — 750 watt for engines to 300 cu in. displacement, 1000 watt to 600 cu in. displacement, 2500 and 4000 watt. 8 pages, illust. Kim Hotstart Mfg. Co, West 917 Broadway, Spokane 11, Wash.

57 HEAVY-DUTY DIESELS — Small, light, 7x8½ in., 900 to 1000 rpm, 200 to 380 hp for continuous service. Specs, weight, performance curves. 12 pages, illust. Form 10027. Ingersoll-Rand Co, 11 Broadway, New York 4, N.Y.

PUMPS

58 INDUSTRIAL PUMPS—96 pages illust information on line of industrial pumps. Catalog I-52. The Deming Co, Salem, Ohio.

59 CENTRIFUGAL PUMPS — Selection guide in chart form, catalog of line, head-capacity table. Bulletin 52C6059J, 12 pages, illustrated. Allis-Chalmers Mfg Co, 952 S 70th St, Milwaukee, Wis.

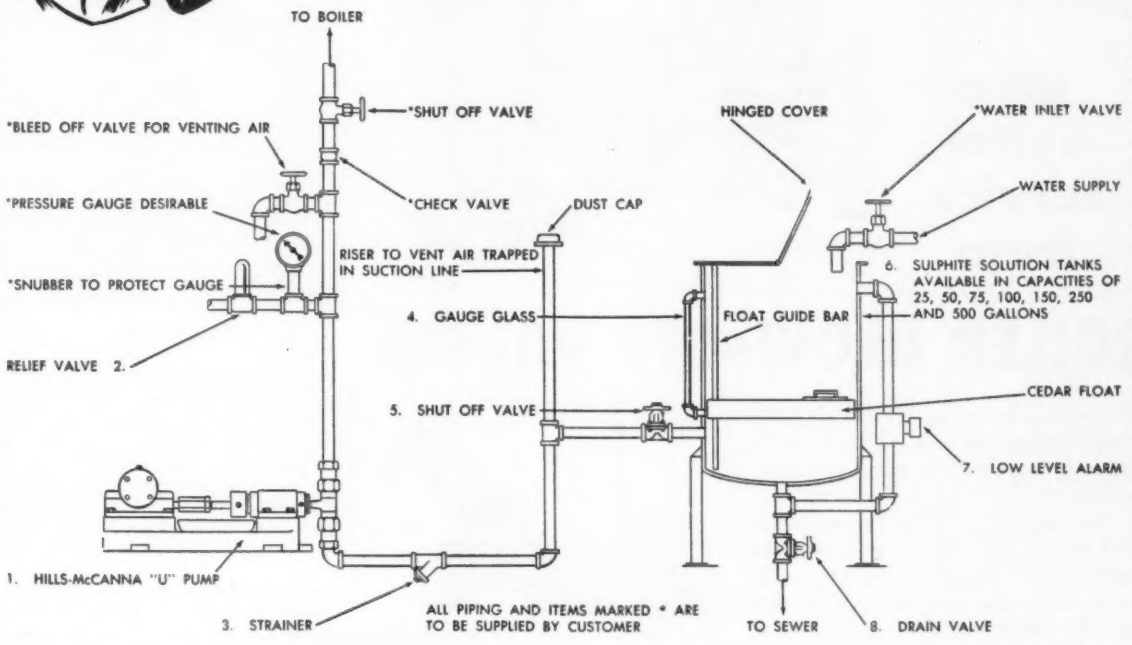
60 ROTARY PUMPS — Installation, operation, maintenance of rotary pumps covered in 12-page service manual. Bulletin 100-2. Warren Steam Pump Co, Inc, Warren, Mass.

61 FRAME-TYPE PUMPS—Designed to handle most ordinary pumping jobs, capacities to 500 gpm, heads to 135 ft. Bulletin 52B6691A, 4 pages, drawings, performance curves. Allis-Chalmers Mfg Co, 952 S 70th St, Milwaukee, Wis.

To get copies of these bulletins, use post cards p 167. Identify your request with item number.

Here's the answer

TO SULPHITE BOILER TREATMENT IN A NEAT "PACKAGE"


TO BOILER
*SHUT OFF VALVE
*BLEED OFF VALVE FOR VENTING AIR
*CHECK VALVE
*PRESSURE GAUGE DESIRABLE
DUST CAP
RISER TO VENT AIR TRAPPED IN SUCTION LINE
*SNUBBER TO PROTECT GAUGE
4. GAUGE GLASS
RELIEF VALVE 2.
5. SHUT OFF VALVE
1. HILLS-McCANNA "U" PUMP
3. STRAINER
ALL PIPING AND ITEMS MARKED * ARE TO BE SUPPLIED BY CUSTOMER
HINGED COVER
*WATER INLET VALVE
WATER SUPPLY
6. SULPHITE SOLUTION TANKS AVAILABLE IN CAPACITIES OF 25, 50, 75, 100, 150, 250 AND 500 GALLONS
FLOAT GUIDE BAR
CEDAR FLOAT
7. LOW LEVEL ALARM
TO SEWER
8. DRAIN VALVE

To meet the power plant engineer's need for an engineered system for treating boiler feedwater, Hills-McCanna now offers a complete "packaged" unit comprising a Hills-McCanna metering pump, solution tank and all auxiliary fittings other than those which are normally carried in stock or are readily available. The system illustrated is for sulphite treatment. Similar packaged units are also available for phosphate treatment. Both systems are available in a wide range of sizes to handle virtually any boiler capacity. Both systems feature tried and proven Hills-McCanna metering and proportioning pumps.

Further information on either the sulphite or phosphate systems will be furnished on request. Literature describing Hills-McCanna metering and proportioning pumps can also be furnished. HILLS-McCANNA CO., 2369 W. Nelson St., Chicago 18, Ill.

HILLS-McCANNA

metering and proportioning pumps

ALSO MANUFACTURERS OF

SAUNDERS TYPE DIAPHRAGM VALVES • FORCE FEED LUBRICATORS • MAGNESIUM SAND ALLOY CASTINGS

These EVERLASTING advantages give better service from

Fig. 4001/6561. Duplex unit consisting of Straightway Lever-operated Sealing Valve and Angle Blowing Valve.

BOILER BLOW-OFF VALVES

When you install an EVERLASTING Duplex Blow-Off Unit, you'll find that its many superiorities speak for themselves.

The sealing valve at the left is the EVERLASTING design that has been famous for more than 40 years . . . the valve with the drop-tight seal that actually improves with use because of its self-lapping action each time the valve is opened or closed . . . the valve that can't stick or jam because of its non-wedge design . . . the valve that opens in less than a quarter turn to provide unimpeded straight-through blow.

The blowing valve at the right is the equally famous EVERLASTING Angle or "Y" Valve, specially designed and equipped to withstand repeated blow-off shocks, erosion and corrosion, and without pockets that might trap and hold solids.

Each of these valves . . . and all the other EVERLASTING Boiler Blow-Off valve types, fully meet ASME code requirements . . . assurance that they are properly designed and amply strong for the service.

Write for descriptive bulletin

EVERLASTING VALVE CO.
49 Fisk Street, Jersey City 5, N. J.

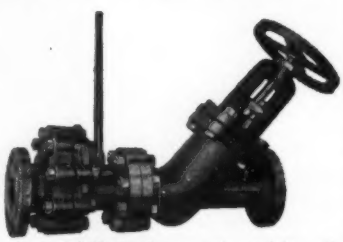


Fig. 4001/6571. Duplex unit consisting of Straightway Lever-operated Sealing Valve and Y Blowing Valve.

Fig. 6571/6561. Duplex unit consisting of Y Sealing Valve and Angle Blowing Valve.

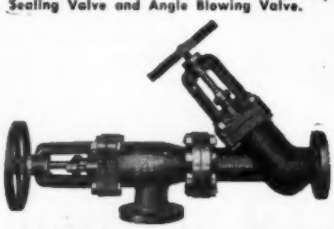


Fig. 6561/6571. Duplex unit consisting of Angle Sealing Valve and Y Blowing Valve.

Everlasting Valves

TRADE MARK "EVERLASTING" REG. U.S. PAT. OFF. EV-348

FOR EVERLASTING PROTECTION

APPOINTMENTS

Corporation Executives

Arthur H Kuljian

Arthur H Kuljian, chief mechanical engineer for **The Kuljian Corp,** Engineers and Constructors, Philadelphia, has been elected vice-president in charge of engineering. Mr. Kuljian has had wide experience in the design and engineering of steam electric power stations, industrial plants, boiler house extensions, and chemical plants, both in this country and abroad.

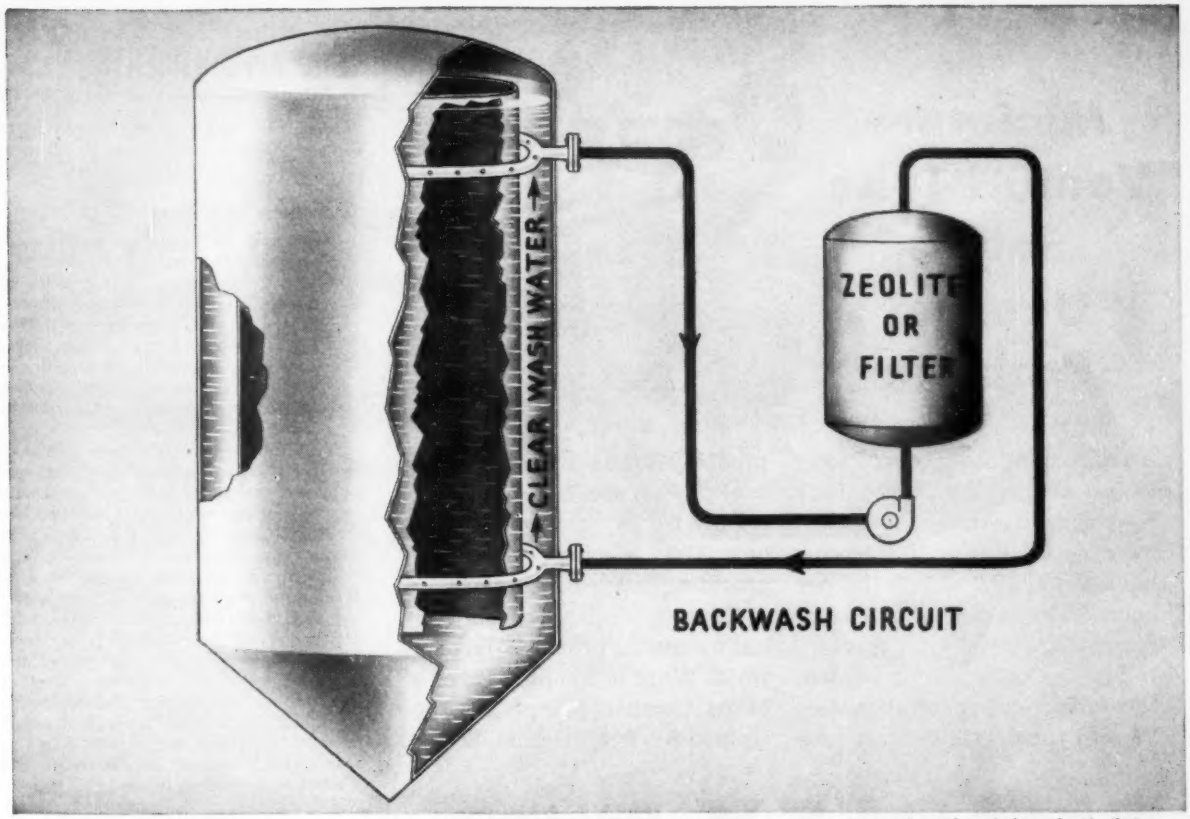
American Locomotive Co elected Perry T Egbert president and William S Morris executive vice-president. **Flexitallic Gasket Co,** Camden, N. J., announces the appointment of A T Erickson as executive vice-president. Guy J Coffey is elected president of **Chicago Pneumatic Tool Co.**

Robert S Sweeney was named vice-president and general manager of **The Watson-Stillman Co. The Griscom-Russell Co,** manufacturers of heat transfer apparatus, has elected Oscar W Heimberger and Robert M Wallace as vice-presidents.

Walter Kidde Nuclear Laboratories, the first privately-financed research organization devoted primarily to the development of nuclear power for commercial and industrial purposes, has established an advisory committee consisting of Dr J R Oppenheimer, wartime director of the Los Alamos, N. Mex., laboratory which developed the atomic bomb; Alexander Sachs, consulting economist and a director of Lehman Brothers, investment bankers; and Dr Harold C Urey, winner of the Nobel Prize in Chemistry in 1934 for the discovery of deuterium (heavy water).

Detroit Stoker Co, announces the appointment of Maynard H Snodgrass as vice-president-sales. **National Conveyors Co, Inc,** appoints John D Romer as vice president in charge of engineering.

William E Buchanan, president and treasurer of the Appleton Wire Works, Inc, of Appleton, Wis., was elected to the board of directors of **Allis-Chalmers Mfg Co.** The appointment of Paul B Wishart to the newly created position of general manager of **Minneapolis-Honeywell Regulator**



BACKWASH FLOW CIRCUIT IN WORTHINGTON HOT-PROCESS SYSTEM shows how *independent* built-in, annular wash-water compartment* provides clean, hot, chemically inert water for backwashing and reclaims it without affecting operating velocities in treating zone, or subjecting hot zeolite to temperature changes. Backwashing is accomplished by recirculation of the clarified wash water.

*Reg. U.S. Pat. Off. 2,263,398

You can't wash clean with dirty water!

How Worthington Hot-Process Water-treating systems backwash with CLEAN, hot, chemically inert water

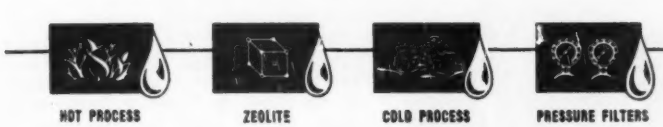
When you're considering hot-process water-treating systems with hot zeolite, filters, or both, *don't overlook backwashing facilities.*

They must be well designed, or the system cannot give smooth, efficient, trouble-free performance. Worthington engineers recognized this fact when they designed their first hot-process system. Today, every Worthington standard Hot-Z or conventional system provides exclusive *independent* facilities for backwashing zeolite or filters with clean, hot, chemically inert water without disturbing the normal flow through the reaction bank.

Worthington water-treating specialists don't believe you can wash clean with dirty water.

This unique backwashing provision is just one of many Worthington patented features, but it alone will more than justify your selection of a Worthington system for hot-processing boiler feedwater in your plant.

If you have a problem, whether it involves filtration, precipitation, or zeolite treatment, Worthington specialists will be happy to study your water-treating problem and recommend the proper system. Just write, stating service conditions in detail, to Worthington Corporation, Water Treating Division, Harrison, N. J. J-2-1

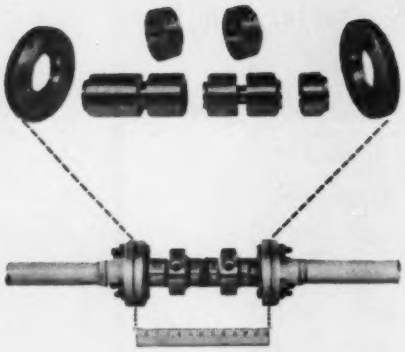


Worthington Makes More of the Equipment for ALL Types of Water Conditioning Systems

WORTHINGTON

Water Conditioning

Miniature Venturi Tube Solves Unusual Problem



An important chemical producer looked everywhere . . . couldn't find a ready-made device to measure accurately a corrosive liquid's low flow of 159 lbs. per hour. So he asked the advice of Simplex.

Simplex tailor-made a welded, corrosion-resisting stainless steel Venturi tube. This Venturi tube probably is the smallest in industrial process use. Main diameter is only 0.375"; throat diameter only .105". Machining to .0005" provides specified accuracy.

Consult Simplex on your special measuring problems, large or small. Write to Simplex Valve & Meter Company, Dept. 1, 6780 Upland St., Philadelphia 42, Pa.

SIMPLEX® VALVE AND METER COMPANY

ALLPAX

GASKET CUTTERS

Avoid Shutdowns!

Cut your own gaskets when you need them . . . quickly, accurately

Be prepared for any emergency by having ALLPAX GASKET CUTTERS, on hand to cut any gasket you need when you need it. Make your plant practically proof against shutdowns from leaks by having these fast, convenient, accurate tools ready for instant use.

You can cut your gaskets from any material up to ¾" thick. There are two types and sizes to meet your needs: the Cutter illustrated cuts from ¼" to 48" diameter; a Junior size cuts from ¼" to 6" diameter. Send today for the ALLPAX Catalog.

ALSO: Packings for all services; special packings to order; Valve Discs; Retainer Packings; Molded and Mandrel-Cut Packing Rings; Packing Hooks.

THE ALLPAX COMPANY INC.

805 Mamaroneck Ave., Mamaroneck, N.Y.

Superheat Sheet Packing . . . Oil Proof Sheet Packing . . . Red Rubber Sheet Packing . . . Diaphragm Sheet Packing . . . Cloth Inserted Sheet Packing

More APPOINTMENTS

Begins on page 242

Co, and his election to the board of directors was announced recently. He continues as vice president.

Operations Executives

Frederic H Holt has been named manager of marketing and James W Cooke, manager of engineering in the **General Electric Co's** Control Dept at Schenectady, N. Y. Irving August, formerly superintendent of **Worthington Corp's** Denver, Colo., plant has been appointed assistant to the works manager of that company's Holyoke, Mass., plant. August has been succeeded by Merril Berman.

Westinghouse Electric Corp announces that R H Proctor has been named manager of manufacturing and Scott Stevenson manager of industrial relations for the Manufacturing and Repair Dept. J G Leach was named superintendent of methods and equipment for the same department. J R Weaver was made manager of manufacturing and engineering for the Springfield, Mass., plant of the Appliance Div. James M Wallace was named manager of the newly-formed Industrial Relations Dept of the Aviation Gas Turbine Division, South Philadelphia, Pa. And James E Woodall has been appointed staff aide to Ralph C Stuart, vice-president in charge of the Westinghouse Lamp Division.

R L Lloyd has been appointed general manager of advertising and R A Wheeler assistant general manager of advertising of the **International Nickel Co, Inc.** Fred B Akerson has been named industrial manager of the Portland, Ore., regional office and Wilson R Coffman was made industrial manager of the Wichita branch office of **Minneapolis-Honeywell Regulator Co.**

Robert Jack is named assistant manager of **Iron Fireman's** growing Heating Control Div in Portland, Ore., and will be replaced by Hugh Russell as divisional controller of the Portland plants. Paul R Rauch has been appointed assistant chief inspector for the Youngstown district of the **Youngstown Sheet and Tube Co.**

Engineers

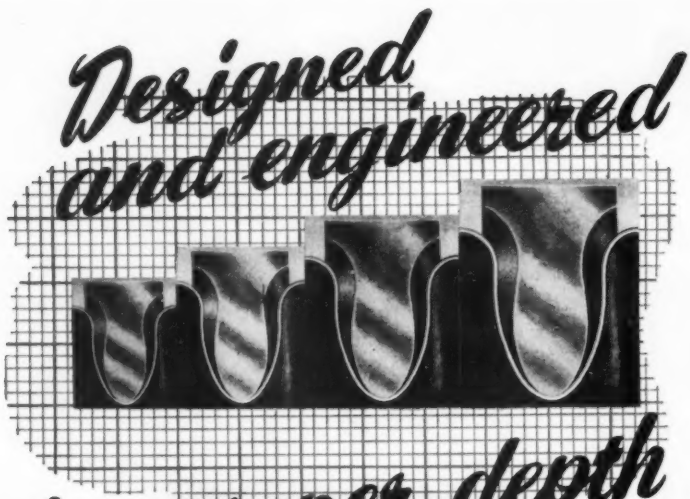
C B Campbell has been appointed consulting engineer, and J R Carlson manager of engineering for the Steam Division of the **Westinghouse Electric Corp.** McAndrew McCall has been named chief design engineer, construction department, Machinery Division, **Dravo Corp.** The appointment of Eugene Schmidt as chief engineer of the **Refinite Corp** was recently announced.

William T Stephens, formerly vice president and general manager of the Valve Service Company, Willoughby, Ohio, has joined the **Parker Appliance Co** as staff engineer in charge of the company's development program of industrial hydraulic equipment. Frederick W Argue has been appointed assistant engineering manager of the **Stone & Webster Engineering Corp.** Jack E Reilly has joined the Industry Engineering Dept of **Elliott Co.**

Sales Managers, Salesmen

Richard McGurk has been appointed

CADWELD® LUGS OR YOUR
OWN FABRICATED BAR STOCK
PLUS
A
CADWELD
CONNECTION
EQUALS
THE FINEST TERMINAL
CONNECTION ON THE MARKET
– 100% relative conductivity
– Cannot loosen or corrode
– Unequaled mechanical properties
– Installed with inexpensive lightweight equipment
The Answer to Design Problems and Special Applications
CATALOG ON REQUEST
ERICO PRODUCTS, INC.
2070 E. 61st Place • Cleveland 3, Ohio



Designed and engineered for proper depth of corrugation

Badger Expansion Joints

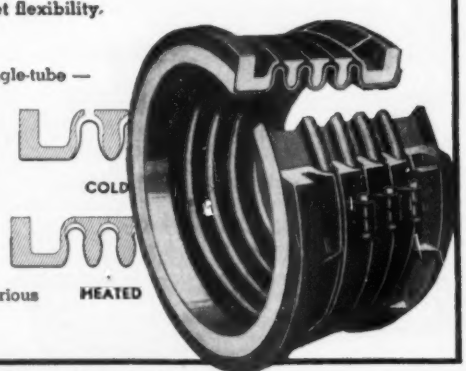
Experience has proven that longer expansion joint life can only be safely assured by varying the depth of corrugation with relation to size and traverse per corrugation. In the regular practice of precision manufacture and engineering Badger Manufacturing Company has established standards for different diameters. *Not just a shallow and a deep corrugation, but precisely the accurate depth of corrugation needed.* Just one of the many important characteristics and reasons you should specify Badger Expansion Joints.

D-F S-E Directed-Flexing Self-Equalizing: an exclusive feature of Badger Expansion Joints. The flexing of the corrugations is progressively directed over each segment of each of the all-curve corrugations by correspondingly shaped self-equalizing rings. Localized stresses are eliminated insuring a more flexible longer lasting joint.

Buy Badger Joints and you get flexibility. D-F S-E and these features:

- Packless . . . pressure-tight single-tube — requires no maintenance
- Compact . . . approximately the size of flanged fitting
- Special forming . . . no structure-weakening stresses
- Controlled heat treating . . . assures long life
- Wide range of traverse — pressure — temperature

Fabricated from deoxidized copper, stainless steel and special alloys to meet various operating conditions.



Original and Sole Manufacturer of Badger Expansion Joints

BADGER MANUFACTURING COMPANY

230 BENT STREET • CAMBRIDGE • MASS.

More APPOINTMENTS

Begins on page 242

sales representative for **Power,** McGraw-Hill publication, in the St. Louis territory.

John K Dustman has been appointed manager of export sales in the New York office of the **Youngstown Sheet and Tube Co.** He succeeds Walter A Davis who died Oct 8. And George D Wick III, formerly in Youngstown district sales office now is representing the company at Charlotte, N. C. He succeeds Clarence D Holland, who, with his wife, was drowned while swimming at Savannah Beach, Ga. last June.

The Fairfield Engineering Co has filled the newly created post of general sales manager with former Contract Division sales manager, Wayne H Kuhn. Taking over as Sales Manager of the Division is W R Reichenstein, former chief engineer. Bruno Rybicki assumes the duties of chief engineer. Ed Dewey is appointed supervisor of sales promotion for the **Fluor Corp, Ltd.** George Chipley now represents **Conoflow Corp** in the state of Wisconsin. Appointment of H M Kirkby as sales promotion manager of the Steam Generator Division of the **Clayton Manufacturing Co** is announced.

James E Vanderveld has been appointed industrial sales manager of the Portland, Me., office of **Minneapolis-Honeywell Regulator Co.** Vincent Cioffi has recently been appointed sales manager of **Belco Industrial Equipment Div, Inc,** and Hapgood Kipp was recently appointed district manager of Belco's Philadelphia office.

General Electric Co announces that James L Townsend has been named manager of advertising and sales promotion of the company's Southeastern apparatus district; Steven C Van Voorhis is now manager of advertising and sales promotion for the company's New York apparatus district; Sidney C Coale is the new manager of advertising and sales promotion for the company's Michigan apparatus district. The appointment of J A Stollman as district representative for General Electric's construction materials Southeastern district has also been announced.

New Sales Offices

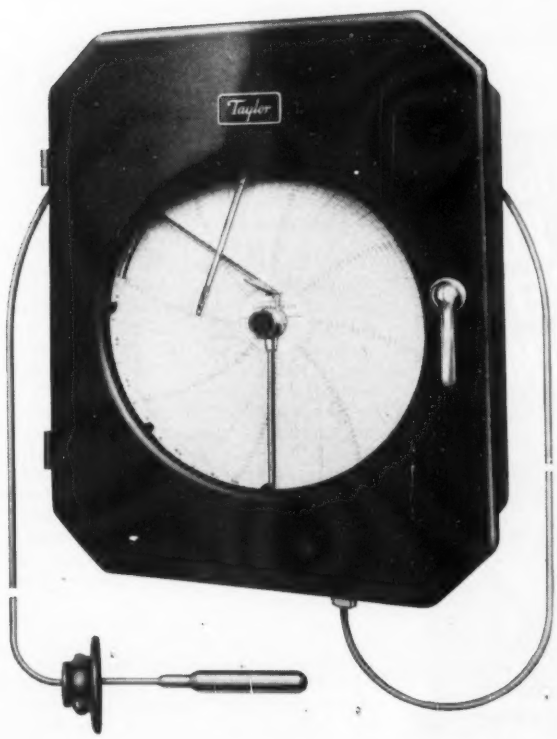
Announcement of the opening of a sales office in Buffalo, N. Y. has been made by **Builders-Providence, Inc,** and **Omega Machine Co.** The new office will be located at 3053 Main St, Buffalo 14, N. Y. **Research Corp** has announced the opening of a new divisional office in Pittsburgh, Pa., located in the Grant Building.

A new Akron branch of the Cleveland district office of **Allis-Chalmers** general machinery division under Fred C Timberman has been announced. The new office is located in the First National Tower in Akron. **The Swartwout Co** announces a district sales office to service Power Plant Equipment and Autronic Control Division accounts in the New England area. The office, which is located at 143 Broadway, Cambridge, Mass., will be under Robert E Alexander, district manager.

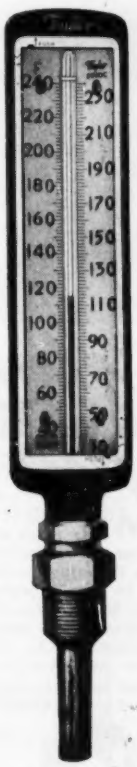
Martin J Sherry has been named manager of **Belco's** new California offices located at 4418 Vineland Ave, North Hollywood. And Joseph Stoy, project engineer

Taylor has an honest face!

6" Dial Indicator with all-new movement design gives greater accuracy, greater flexibility of adjustment and greater convenience, for temperature, pressure and load applications. For temperature, short range spans from minus 100° to +1200°F. For pressure from 12 psi to 20,000 psi. New die-cast aluminum case can be face or flush mounted, is fume and moisture proof. Special pointer permits easy accurate zero settings. **Write for Bulletin 98214.**



Taylor Industrial Thermometer has exclusive, 3-times-easier-to-read BINOC* tube. Fast, precise indications. Available in wide variety of stem angles and connections, and in many standard ranges within minus 40° to +950°F or equivalent Centigrade. **Write for Catalog E.**



Taylor Recording Thermometer gives accurate minute-by-minute chart record of temperature. Mercury, vapor, gas or organic liquid actuation. Temperature range minus 125° to +1200°F or equivalent Centigrade. Hundreds of charts with short or long ranges to choose from, and a wide variety of bulb forms and connecting tubing, both armored and unarmored. One, two or three pen models. **Write for Catalog 76J.**

Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.

Taylor Instrument Companies
Rochester, N.Y., and Toronto, Canada

*Reg. U. S. Pat. Off.

TAYLOR INSTRUMENTS MEAN ACCURACY FIRST

For Temperature Control

$35 Nicholson Trap Replaces $200 Unit

Again demonstrating their remarkable effectiveness as a low-cost temperature control, a large processor reports Nicholson expansion steam traps, at about $35 each, are being installed on outdoor tanks and stills in place of temperature controls. These were costing $110.00 to $200.00, with cost of trap added.

The Nicholson traps are readily adjusted to pass condensate at any temperature below 212°F. No air binding. Lengths, 9" to 40". Easily installed, usually without supports. Pressure, 0 to 250 lbs.

For All Equipment Using Staem or Hot Water

Dryers
Evaporators
Heat Exchangers
Heaters

Kettles
Paper Machinery
Pipe Coils
Radiators

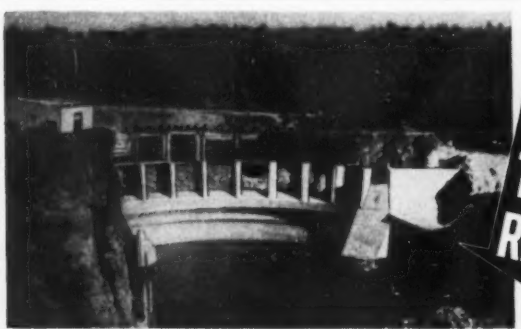
Retorts
Separators
Steam Stills
Storage Tanks

CATALOG 751

125 Oregon St., Wilkes-Barre, Pa.

W. H. NICHOLSON & CO.

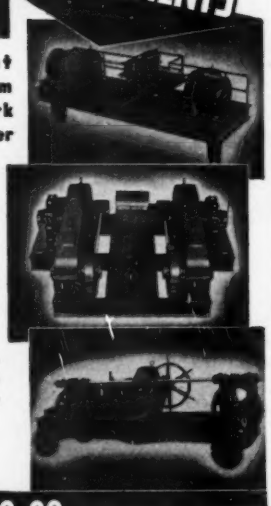
TRAPS · VALVES · FLOATS



DESIGNED AND BUILT TO MEET ALL REQUIREMENTS

Murray GATES & GATE HOISTS! for any Size Power Dam

Cabinet Gorge Dam On Clark Fork River Idaho



MURRAY GATE HOISTS are designed and built in a wide range of capacities from less than one ton to over one hundred tons . . . from the smallest hand operated to the largest motor operated gate hoist.

In over 50 years of designing and building gate hoists, we have developed designs for many gate hoist problems. We may have designs and patterns to fit your special requirements. In planning gates or gate hoists, we suggest you write us before your over-all plans are complete . . . it may save time and money. We also build gate hoists to fit your plans and specifications.

Write for complete information and Engineering Department recommendations.

MURCO

D. J. MURRAY MANUFACTURING CO. WAUSAU, WIS.

More APPOINTMENTS

Begins on page 242

with Belco for the past three years, has been appointed branch manager of their new Texas offices, located at 2009 Fannin St, Houston.

Distributors, Representatives

Appointment of Huckabee, Inc, Sewickley, Penn., as marine and industrial distributor for Nordberg Type 4FS Diesel engines in western Pennsylvania and northern West Virginia is annouced by **Nordberg Mfg Co.** The Hesler Co, which has represented the **Terry Steam Turbine Co** in Kansas City, Mo., since 1946, has recently opened an office at 1110 Brentwood Blvd, St. Louis 17, Mo.

Warren Steam Pump Co, Inc, announces the appointment of J F Murray Co, 100 East Pleasant St, Baltimore 2, Md, as their representatives on industrial sales for the Baltimore area. The **General Electric Co's** Welding Department is now a national distributor of DryRod Electrode Ovens.

Globe Steel Tubes Co appoints Industrial Equipment Co, 1791 Chicago St, Orlando, Fla, as a distributor for Globe seamless welding fittings and flanges. Nielsen Hydraulic Equipment, Inc, 298 Lafayette Street, New York 12, N. Y. is now a distributor for industrial tube fittings and tube working tools manufactured by the **Parker Appliance Co.**

New Names, Consolidations, etc.

Riley Stoker Corp and **John Brown & Co, Ltd,** of Sheffield, England, announce an agreement whereby Riley Steam Generating and Riley Fuel Burning Equipment will be manufactured by John Brown in Great Britain for use in various parts of the world.

Aluminum Co of America announced its plans to build a new fabricating plant in the Lancaster, Pa. area for production of aluminum screw machine products, fasteners, rivets and nails. **The Jet-Vac Corp** has recently been organized in Boston as an affiliate of the Artisan Metal Products, Inc, to design and manufacture ejectors and allied equipment.

Shareholders of National Fireproofing Corp voted to change the corporation's name to **Nateo Corp,** because the old name is no longer descriptive of its business and because its trade mark "Natco" has been well identified with its product since 1910. Delta-Star Electric Co has been merged into the parent company, **H K Porter Co, Inc,** and will operate as Delta-Star Electric Division.

A new manufacturers' representative organization, **Hudson-Rush Co,** has been formed to handle heat transfer equipment, controls for process industries, and large engine auxiliaries. Principals represented and products to be offered are: Barco flexible and revolving joints, Brown Fintube sectional heat exchangers and elements, Conoflow pneumatic operators and valves, Continental butterfly valves, Kristi Tennite II plastic tubing, Mercoid mercury switch equipped automatic controls, and Peco oil filters. Offices will be in Shreveport, La. and Dallas, Tex.

William G Christy, former Director of

HOT LIME–AMBERLITE IR-120...

An Economical Method for Treating Boiler Feedwater

The use of AMBERLITE IR-120 cation exchange resin following the hot lime process eliminates the need for soda ash and sharply reduces phosphate requirements in the treatment of boiler feedwater. Results:

1. **Lower operating costs**—The cost of salt regenerant for AMBERLITE IR-120 is very much lower than the cost of soda ash and phosphate.
2. **High quality feedwater**—High capacity AMBERLITE IR-120 yields water of virtually zero hardness regardless of fluctuations in influent water composition. The resin permits use of excess lime, which results in steam having lower carbon dioxide.
3. **Long trouble-free service**—AMBERLITE IR-120 is stable toward heat, alkali, and acid.
4. **Simplification**—Smaller space is required for AMBERLITE IR-120 exchanger units than for second stage phosphate settling tanks. Only one chemical—lime—is used in the hot process.

For more complete information about economical feedwater treatment with AMBERLITE IR-120, write Dept. P-2. For bi-monthly reports on new developments in ion exchange, ask to receive AMBER-Hi-LITES. No obligation.

CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

THE RESINOUS PRODUCTS DIVISION

Washington Square, Philadelphia 5, Pa.

Representatives in principal foreign countries

AMBERLITE *is a trademark, Reg. U.S. Pat. Off. and in principal foreign countries.*

look to LEE

HEATERS SINCE 1918

direct-fired heaters for industry to help

INCREASE EFFICIENCY and PROFIT

brings comfort to workers . . . reduces absenteeism

Uneven temperatures cause discomfort, sickness, disgruntled workers, lower efficiency, reduced work output and especially absenteeism.

Winter and summer, you can depend on Lee completely engineered heaters to efficiently keep your plant at even-temperatures with balanced air. Avoid drafty, turbulent air carrying-dirt and dust, causing work spoilage, damaged products and the high cost of lost man-hours.

a direct service of LEE

Lee Corporation maintains complete engineering service in all major branches of engineering:

• ELECTRICAL • MECHANICAL • POWER HOUSE
• STRUCTURAL • BOILER ROOM • DESIGN
• HEATING AND VENTILATING

SPECIFY LEE The completely engineered heater

LEE CORPORATION
(HEATERS SINCE 1918)
1011 TATNALL STREET, WILMINGTON, DELAWARE
Baltimore, Md. Chicago, Ill. New York, N. Y.
Representatives in all principal cities

LEE HEATERS SINCE 1918

More APPOINTMENTS

Begins on page 242

Houses and Buildings, Bureau of Smoke Control, New York City, has opened consulting engineering offices at 34 Park Row, New York 38, N. Y. He will specialize in air pollution control, combustion, and fuel and refuse burning plants.

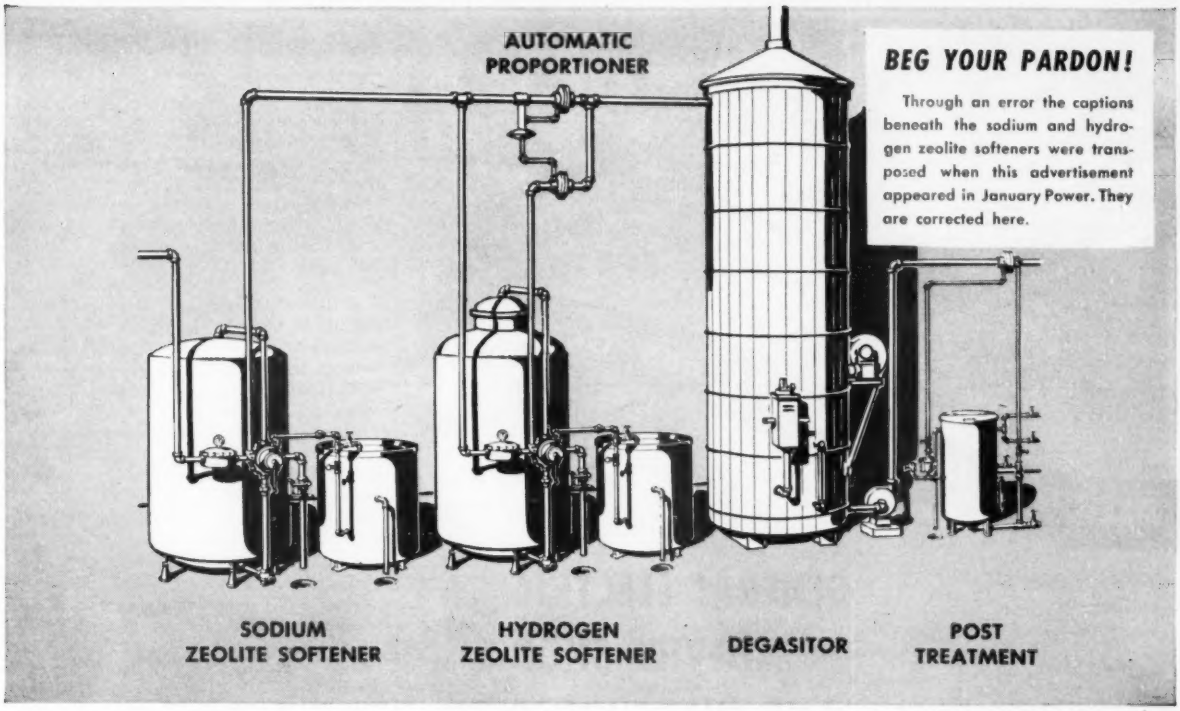
Societies, Schools, Foundations

L F Hickernell, chief engineer, Anaconda Wire & Cable Co, Hastings-On-Hudson, N. Y. has been elected a member of the board of directors of the **American Institute of Electrical Engineers.** His term as director begins on January 1, 1953 and extends through July, 1954. Nelson S Hibshman, formerly dean of the School of Engineering, Pratt Institute, Brooklyn, has been appointed assistant secretary of the AIEE.

The appointment of J H Frankfort as chief project engineer for **Walter Kidde Nuclear Laboratories** was announced. Dr F T Mavis, Head of the Civil Engineering Department of Carnegie Institute of Technology, has been elected president of the Pittsburgh section of the **American Society of Civil Engineers** for 1953. Harry C Davis, general manager, Kanawha Mfg Co, has been elected president of the **Conveyor Equipment Manufacturers Assoc.**

At the annual meeting of the **Diesel Engine Manufacturers Assoc** in New York the following officers were elected for 1953: President, A W McKinney, executive vice president of The National Supply Co of Pittsburgh; vice-president, Walter A Rentschler, vice president of Baldwin-Lima-Hamilton Corp; vice-president, William E Butts, president of Enterprise Engine & Machinery Co of San Francisco; treasurer, Robert H Morse, Jr, president of Fairbanks, Morse & Co, and as secretary and executive director, Harvey T Hill of Chicago.

A British firm has been awarded the contract to furnish two transformers for a City Light substation at Seattle. The **English Electric Export & Trading Co, Inc,** not only bid low at $691,620 but its bid was firm while four American firms specified escalation clauses of 20% to protect themselves against increases in labor-and-material costs. Low American bidder was the Pennsylvania Transformer Co at $815,920. The English firm, a subsidiary of the English Electric Co of Stafford, England, will not be able to deliver the first transformer until April of 1955, approximately six months later than City Light had specified, but the later delivery was reported to be acceptable to the city. The transformers will step down voltage from City Light generating plants on the Skagit River. English Electric is low bidder on another Pacific Northwest power equipment contract calling for four generators for the Corps of Engineers' Chief Joseph Dam on the Columbia River. Its figure is $4,406,493 as compared to the $4,966,363 bid of the Westinghouse Electric Corp., currently engaged in building the first four generators for the dam, second largest in the U. S.



BEG YOUR PARDON!

Through an error the captions beneath the sodium and hydrogen zeolite softeners were transposed when this advertisement appeared in January Power. They are corrected here.

This Elgin "Split Stream DeAlkalizing" System

Eliminates Boiler Scale, Corrosion, and Excess Alkalinity At Taylor Oil and Gas Company

Taylor Oil and Gas Company, Corpus Christi, Texas is one more in a long list of well known firms that have selected Elgin Water Conditioning for their exacting requirements.

With the system graphically illustrated above, blended effluents from sodium and hydrogen zeolite water softeners, followed by degasification, give zero soft water in which total solids and alkalinity is reduced and CO_2 is removed. Boiler water alkalinity is kept in proper proportion to total dissolved solids. The dissolved solids have been reduced 34.5%. (On waters of higher alkalinity, a greater reduction is obtained.) Blowdown is reduced approximately 35%. Think how much this alone saves. Costly destruction resulting from return line corrosion is prevented. And as an extra dividend, post-treatment costs are cut to a minimum.

THIS CHART TELLS THE STORY

WATER CONSTITUENTS	RAW WATER Gr/Gal	TREATED WATER Gr/Gal
Carbonate (Alkalinity)	4.95	0.73
Sulfate	3.15	3.15
Chloride	4.08	4.08
Calcium	3.04	0.03
Magnesium	0.42	0.02
Sodium	3.66	4.68
Total Dissolved Solids	19.30	12.69
Reduction in Dissolved Solids		**34.5%**

Why Not Obtain Comparable Improvement in Your Boiler and Process Water?

A Complete Line To Meet Your Specific Needs

This is but one of our many water conditioning systems. We make all types, ranging from the outstanding "Double-Check" zeolite water softener which gives up to 44% more soft water, to the Ultra-Delonizer which produces water of the highest known chemical purity.

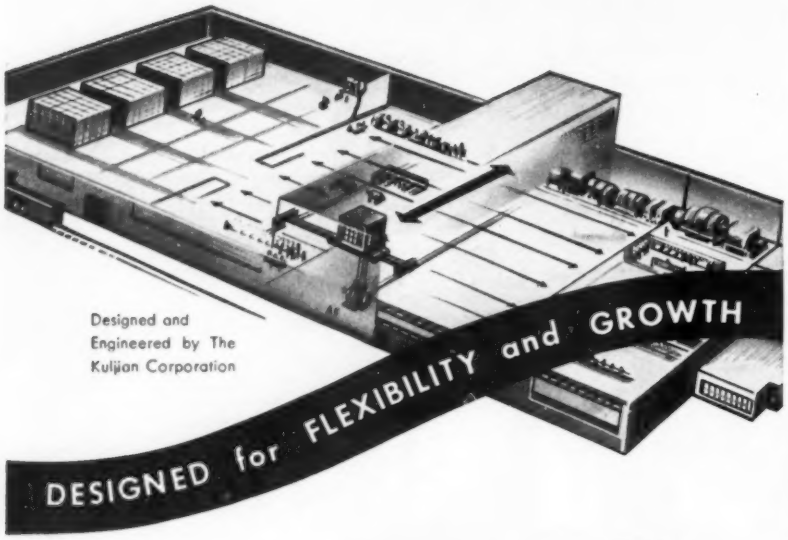
Write for details or let us put our nearest representative in touch with you.

Representatives in Principal Cities

ELGIN
SINCE 1908
WATER CONDITIONING
FOR EVERY NEED

ELGIN SOFTENER CORPORATION • 130 North Grove Avenue, Elgin, Illinois

In Canada: G. F. Sterne & Sons, Ltd., Brantford, Ontario



GENERAL ELECTRIC SERVICE SHOP AND WAREHOUSE

The new General Electric Service Shop and Warehouse in Philadelphia is a striking example of a building properly designed to permit flexibility of operation and future growth.

- One-floor design featuring a high, central bay to which the various departments have direct access, plus large and small overhead cranes with transfer tracks that expedite easy cross-shop movement of heavy apparatus—all this and more adds up to three flexible acres under a single roof.
- The Kuljian Corporation offers technical knowledge and experience—whether your problem deals with general industrial design, power generation, utilization or construction.
- A phone call or letter will bring a Kuljian engineer to your desk promptly for preliminary consultation without obligation.

The **Kuljian** *Corporation*

ENGINEERS • CONSTRUCTORS

1200 North Broad Street, Philadelphia 21, Pa.

MEXICO CITY • CARACAS • MADRID • ROME • ATHENS • TOKYO • CALCUTTA

More POWER NEWS

Begins on page 152

Philadelphia Electric Co will spend $3,900,000 to expand and accelerate its long-range smoke abatement program in the next five years. This will swell the company's expenditures for air pollution control to a total of $7,400,000 since it was started nearly twenty years ago.

A big new hydroelectric development to be built by **Quebec Hydro-Electric Commission** on the Bersimis River that will have an initial capacity of 500,000 hp and cost $100,000,000 is scheduled for 1956 operation. The concrete dam 200 ft high will form a reservoir of 9,000,000 acre-ft capacity. A 7.5-mile tunnel will lead the water to the power house, where the turbines will operate under an 870-ft head. This plant is being designed for an ultimate capacity of 1,000,000 hp.

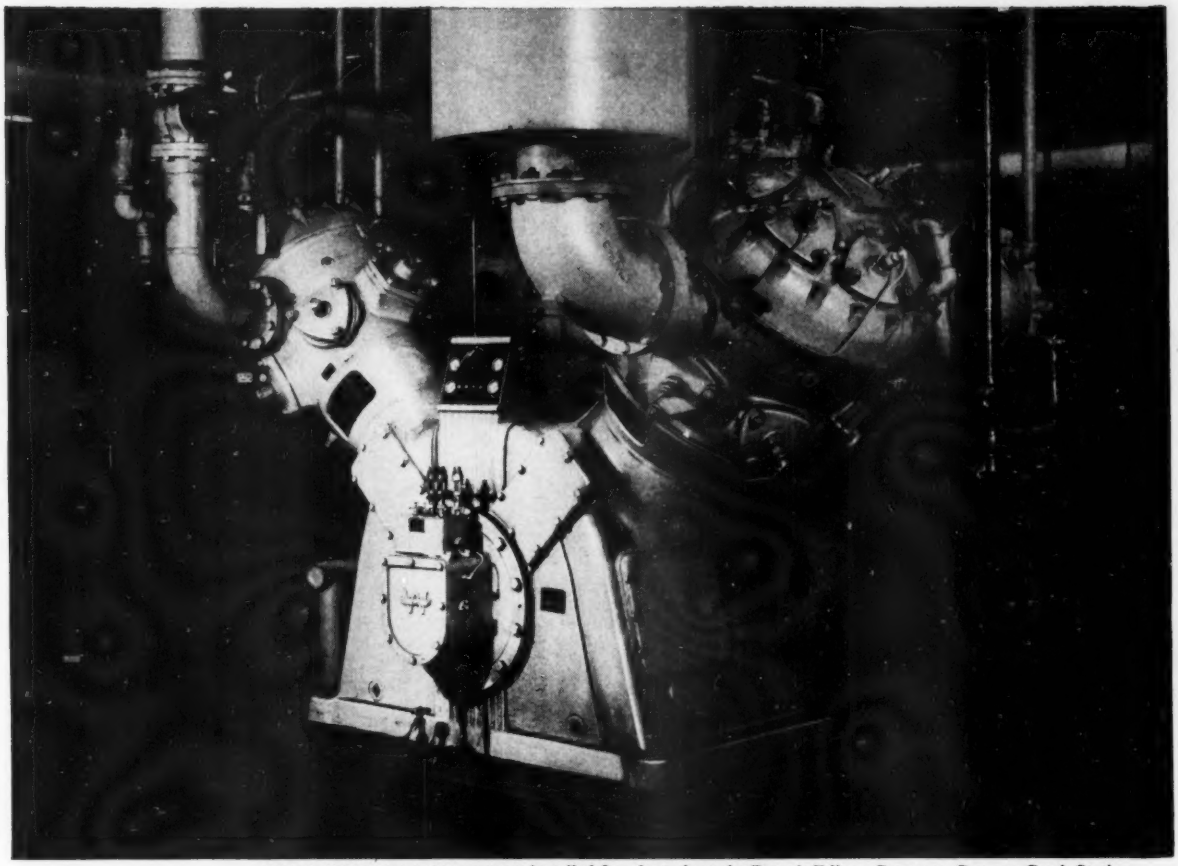
Part of the power will serve the Gaspe Peninsula where Noranda Mines plans to develop huge copper deposits. Four submarine cables will be laid under the St. Lawrence River from west of Baie Comeau on the north shore to Les Boules on the south shore. The cables will be 3.5 miles long and at the deepest point will be 1200 ft below the river's surface.

A submarine cable linking the United Kingdom and France is now under discussion to let the hydro power sources of the Alps feed England in the winter and save valuable British coal and in the summer permit England to feed France during drought periods.

Philadelphia Electric Co has found the answer to a problem which has plagued many utilities in recent years. That problem is the acquisition and maintenance of complete up-to-date maps to use in company planning and construction projects. To meet this need, Philadelphia Electric is having the entire four-county Philadelphia suburban area it serves remapped to its own specifications, which were carefully drawn by its engineers, in consultation with specialists in the utility mapping field.

The project was done in two stages. First, an aerial survey was made. Then base drawings were made from the photo-maps and reproduced on plastic sheets. From these plastic drawings, reproductions can be made photo-graphically at scales varying from 100 feet to an inch, to 3,000 feet to an inch. The aerial survey and photo-map was made by Aero Service Corporation of Philadelphia.

In the heart of the natural gas area of Texas, the **Aluminum Co of America** is building a $100 million plant to produce aluminum with power generated by lignite coal. Texas Power and Light Co will furnish the power, processing about 7000 tons of lignite a day. It will produce 3200 tons of char and 2300 barrels of coal tar. The char will be pulverized and blown under the boilers, burning like gas.



WORTHINGTON YC-2 COMPRESSOR installed for plant air at the Detroit Edison Company Conners Creek Station.

Why Worthington customers are repeat customers

At Worthington we naturally welcome "repeat" customers.

We do our best to cultivate them by building the most efficient compressors we can. This is particularly true of the YC-2 compressor. No other air compressor offers greater operating savings.

You save installation costs. YC-2 comes completely assembled—no alignment problems, no erecting engineer needed.

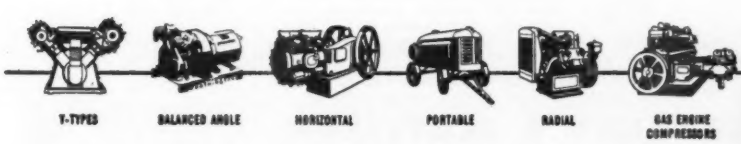
You save power. Worthington Feather® Valve is simplest, lightest, tightest. Maximum number of valves means lower velocities, less friction, and *less power.* 3- or 5-step instantly responsive control matches capacity to the varying amounts of air your shop needs, with lower power consumption at partial load.

You save space. YC-2 requires one-half the space, one-fourth the foundation of horizontal compressors of the same capacity.

You save maintenance. Entire running gear is pressure-lubricated, features anti-friction main bearings.

Write for Bulletin L-667B1B. Worthington Corporation, Compressor Division, Buffalo 5, New York.

K.2.11



No Other Compressor Will Outperform a Worthington

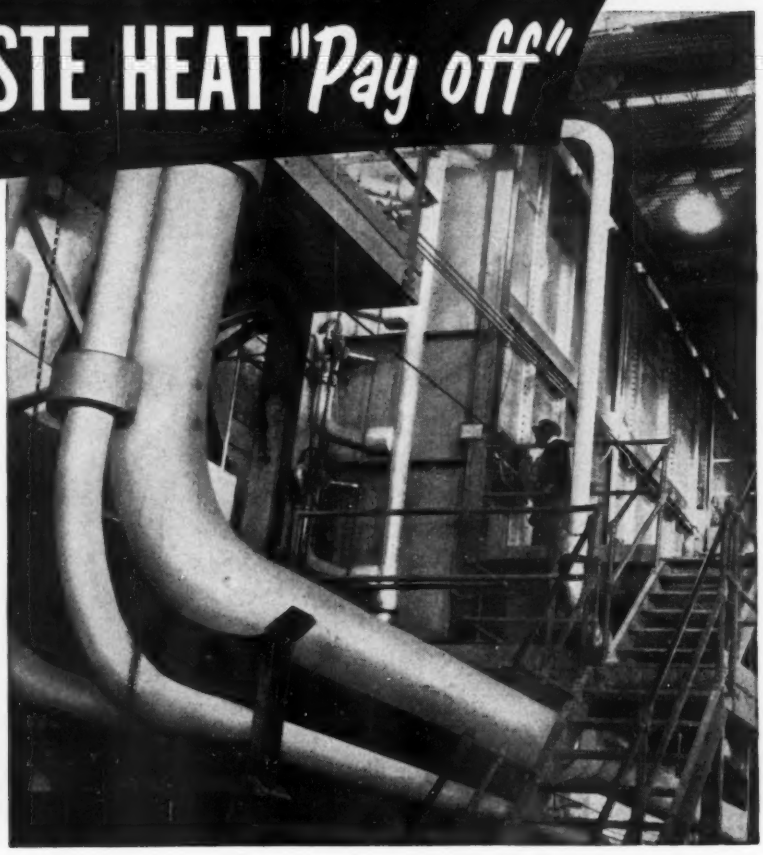
WORTHINGTON

Compressors

MAKING WASTE HEAT "Pay off"

with

the help of K&M insulations



One of the East's large cement companies gets all the electric power it needs for plant operation by utilizing the waste heat from its cement kilns. This heat is first directed to a boiler which produces a continuous supply of 700°F. steam. This, in turn, is piped to a power-generating turbine—and that's where K&M insulations come in!

So that heat loss is held to a minimum, two effective K&M insulations have been used in combination on the main steam header: a 1½" layer of "Featherweight" 85% Magnesia over a 1½" layer of Hy-Temp insulation. For two smaller boiler-feed water lines, a 1½" layer of "Featherweight" 85% Magnesia is sufficient. All pipes have been finished with a canvas jacket and painted.

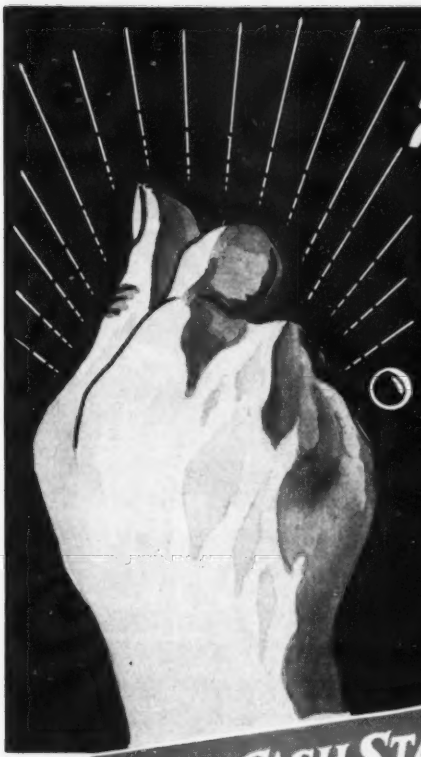
K&M "Featherweight" 85% Magnesia is a versatile, dependable, economical insulation for applications up to 600°F. Combined with Hy-Temp, it is efficient on installations having temperatures up to 1900°F. Both materials are supplied in a wide variety of forms and thicknesses.

Your K&M distributor, an experienced applicator, will gladly answer your questions about these products and their uses. Call on him soon, or write to us for complete information.

Nature made Asbestos . . . ***Keasbey & Mattison has made it serve mankind since 1873***

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

In Canada: Atlas Asbestos Co., Ltd., Montreal, Toronto, Winnipeg, and Vancouver



An Opportunity THAT KNOCKS ON BOILER ROOM DOORS

WITH ASSURANCE OF

Less Fuel Costs

Larger Boiler Capacity

Savings in Maintenance

CASH STANDARD AUTOMATIC COMBUSTION CONTROL SYSTEMS

• CASH STANDARD instruments maintain the proper proportion of air supply continuously so that you get continuously effective combustion . . . where such controlled combustion exists, there is no under-firing to cut steam supply nor over-firing to waste fuel. Through the proper operation of the stack damper, heat is not absorbed by excessive air above the fire and thereby lost through the stack . . . the heat goes direct to the boiler water to give you more steam.

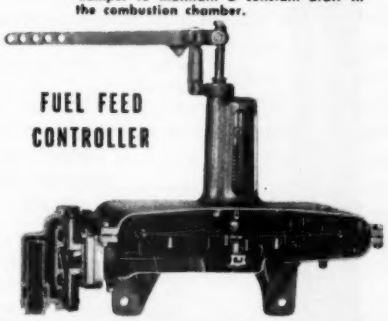
CASH STANDARD Units, available in a number of variations, can be combined to make a most accurate and dependable Automatic Combustion Control System to meet any condition and work on any boiler or stoker with any kind of fuel.

Write today for Bulletin No. 300

FURNACE DRAFT CONTROLLER

This CASH STANDARD Furnace Draft Controller (which comes complete with Operating Power Cylinder) works from over-fire draft, regulating the boiler uptake damper to maintain a constant draft in the combustion chamber.

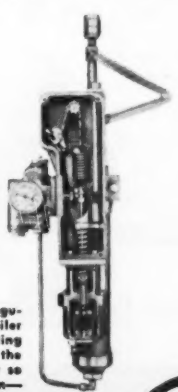
FUEL FEED CONTROLLER



This CASH STANDARD Air Flow Controller meters the air needed for combustion. Install it near its damper. It is not affected by changes in fuel bed resistance or any other variables, because it meters air supply according to the differential pressure through the gas passages of the boiler, doing its part to insure perfect combustion.

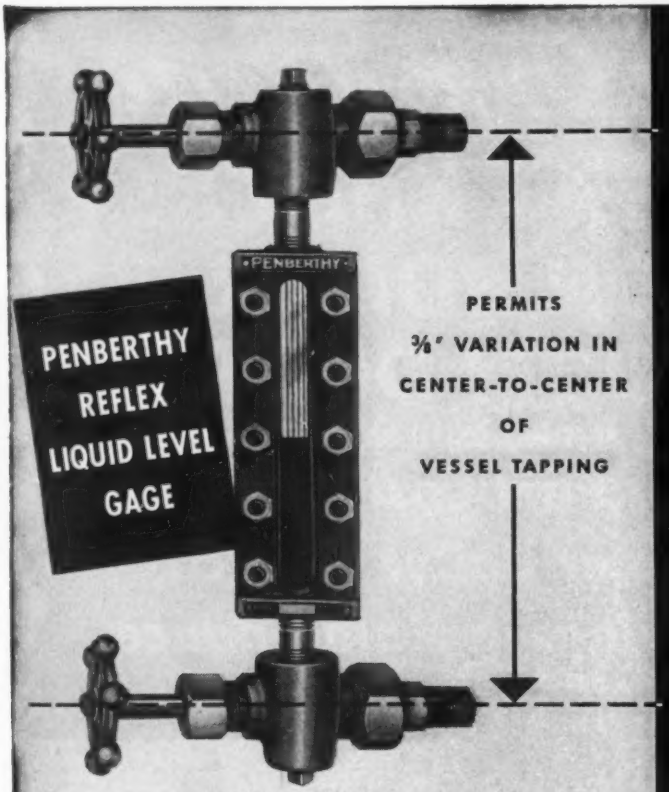
AIR FLOW CONTROLLER

This CASH STANDARD Master Controller automatically regulates fuel feed. Locate it conveniently. Working from boiler pressure, it will adjust the rate of combustion by regulating the rate at which fuel (any kind of fuel) is supplied to the boiler furnace. And it will adjust the Air Flow Controller so the correct amount of air is supplied for proper combustion—hence, money saving.



A. W. CASH COMPANY
DECATUR, ILLINOIS

CASH STANDARD CONTROLS . . VALVES



PATENT APPLIED FOR

Another PENBERTHY First

PENBERTHY "Floating Shank"

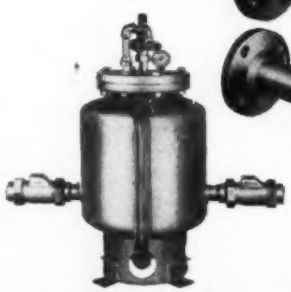
Saves Time and Money in Gage Installation

A feature available only on Penberthy drop forged steel (and alloy) gage valves, the "floating shank" automatically compensates for as much as 3/8" variation in the center-to-center distance of the vessel tapping. This saves time and cuts the cost of gage installation . . . eliminates stresses often induced during mounting. Penberthy "floating shank" is available at slight additional cost. It will pay you well to specify "floating shank" on your next gage order.

OTHER PENBERTHY PRODUCTS

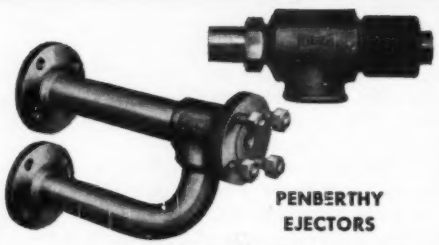
PENBERTHY TRANSPARENT GAGE

Used to observe color and density of liquids under high pressures and/or temperatures. Exceptionally sturdy construction—liquid chamber machined from solid block of metal. Ask for Catalog 35.



PENBERTHY CYCLING JET PUMPS

Automatically operated by air, gas or steam pressure . . . Will pump without clogging any liquid that will flow through pipes. Ask for Bulletin 5030.



PENBERTHY EJECTORS

A simple jet pump operated by air, water or steam. Needs no lubrication . . . will not get out of order. Made in wide variety of materials and special units developed to meet unusual conditions. Ask for Bulletin 512.

4671

PENBERTHY INJECTOR COMPANY

DIVISION OF THE BUFFALO-ECLIPSE CORPORATION

DETROIT 2, MICHIGAN

Established 1886 — *Canadian Plant, Windsor, Ontario*

We can learn from bankrupt Micawber

"MY advice, Copperfield, you know. Annual income twenty pounds, annual expenditure nineteen-nineteen-six, result happiness. Annual income twenty pounds, annual expenditure twenty-ought-six, result misery. The blossom is blighted, the leaf is withered—in short you are forever floored. As I am!"

This is probably the most famous financial counsel in all English literature, offered a hundred years ago by Charles Dickens' character the bankrupt Micawber to the hero David Copperfield. As advice it is just as good in 1953 as it was in 1849, and just as sound for a nation as for an individual.

In 17 of the last 20 years, Uncle Sam has followed Micawber's practice, not his advice. Our national balance sheet has been, figuratively, "annual income twenty pounds, annual expenditure twenty-ought-six". Ahead of us as a nation, if we continue this irresponsible policy, is Micawber's dire predicament, "blossom blighted, leaf withered—forever floored".

There is no sane reason why the world's richest nation should continue to live the financial life of a profligate bankrupt. It is time now to set our house in order. The program called for is simple: (1) Eliminate waste and extravagance in government spending; (2) Balance the Federal budget; (3) Control the national debt and reduce taxes.

By such positive action we can protect future happiness—and prevent misery—for ourselves, our children and our children's children.

QUALITY
YOUNGSTOWN
SERVICE

The Youngstown Sheet and Tube Company

General Offices--Youngstown 1, Ohio
Export Offices--500 Fifth Avenue, New York

MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

RAILROAD TRACK SPIKES - CONDUIT - HOT AND COLD FINISHED CARBON AND ALLOY BARS - PIPE AND TUBULAR PRODUCTS - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - RODS - SHEETS - PLATES.

Announcing

AN EXTRA SERVICE FOR THE

— carefully planned and dramatically

timed to give you the most useful facts

and measurements of a new trend

in U.S. industry

— a trend holding vital significance

for everyone close to the power field.

What change will take place in capital investment in 1953?

It is the shift in emphasis, among most industries in 1953, from *expansion* to *modernization*.

The U. S. industrial machine has built 9,100 *more* major manufacturing plants than we had in 1939. In the last two years our capacity to produce has increased 16 percent. Plant expansion has been rolling at a gargantuan 23½ *billion* dollars a year.

By mid-year of 1953, the U. S. industrial plant will have nearly enough capacity to produce the things we use in civilian life, plus the arsenal requirements of national defense. As a consequence, the new major objective of most industry investment will be to modernize, rather than to build new plants.*

Watch for

THE MODERN PLANT HANDBOOK

to be published

IT WILL BE DISTRIBUTED TO ALL REGULAR

READERS OF **Power**

And the most eligible area in most plants or modernization—providing maximum efficiency and high economy—is the power system.

Timed to coincide with this shift in capital investment, Power's MODERN PLANT HANDBOOK will combine a comprehensive editorial report on plant modernization with a full directory of power-field manufactured products. We believe you'll find it a highly useful reference work, providing valuable information throughout the year.

*Except for utilities. The U. S. demand for more power still requires expansion of generating capacity . . . and utilities will build over 9 million kw of new capacity in 1953. But, as most power engineers know, one sure way to increase utility output has always been *modernization.*

ISSUE

September 15, 1953

Power SUBSCRIBERS.

HOW WILL THIS HANDBOOK ISSUE WORK FOR YOU?

MODERN PLANT SURVEY

Twenty-four pages with tabulated technical details on five hundred new steam and hydro plants. Capacity, design trends, major equipment. Includes data on plants newly completed, in construction, and planned.

THE RENOVATION ROUND TABLE

A forum of top opinion compiling careful reports by leading consultants and industry-engineers, on power system modernization. What's doing now, and what's ahead.

DIRECTORY OF POWER-FIELD MANUFACTURERS

The only directory of power-field equipment and who makes it. Over six hundred product listings with names and addresses of more than one thousand manufacturers.

CROSS FILE OF OBSOLESCENCE

Names of former manufacturers of power-field equipment, matched with name of successor company. Especially useful in any general campaign of modernization where obsolete equipment is being replaced or renewed.

THE SHOW CASE

Devoted to many of the new products which will be needed to modernize power-systems. Name of manufacturer in every case. A double order card in the issue will make it easy for readers to get additional information.

Note to Power readers: Is your plant setting up plans to renovate or modernize its power system in 1953? Perhaps you can already see particular problems ahead. Maybe you have an idea that would be worth passing along. Power's editors would like to hear your ideas on modernization. Write us.

No job is too unusual for NAVCO

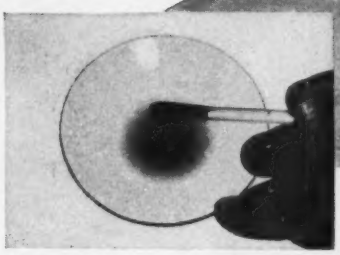
Whether you require a simple pipe bend or a complicated prefabricated assembly Navco can help you. As shown above, Navco Shops are equipped to handle Chrome Moly, Stainless, Carbon Steel and Copper, in addition to any of the many other Ferrous and Non-Ferrous materials.

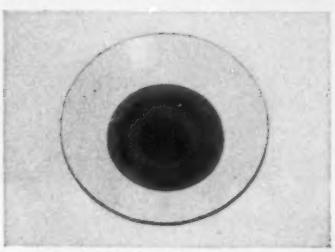
NAVCO PIPING

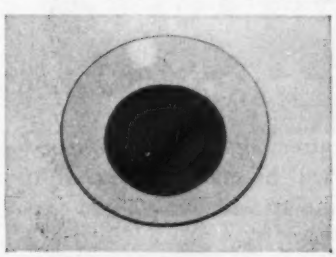
NATIONAL VALVE & MANUFACTURING COMPANY • PITTSBURGH, PA.

NEW YORK • CHICAGO • CLEVELAND • BOSTON • ATLANTA • BUFFALO • CINCINNATI

NOW . . . See for yourself







See for yourself how, in a few seconds, PEROLIN FUEL OIL TREATMENT can convert useless sludge into useful fuel.

Almost six thousand engineers on land and sea have chosen PEROLIN—the Complete Fuel Oil Treatment. You, too, can now see at your own desk how PEROLIN breaks up sludge and converts it into usable, high-BTU fuel. It also emulsifies water, and helps to increase greatly the efficiency of your burners.

We invite you to see this revealing demonstration by a PEROLIN Service Engineer and then to try PEROLIN FUEL OIL TREATMENT in your own plant. Compare it with any fuel oil additive, sludge solvent or catalyst on the market. Judge by actual results and you, too, will become a regular PEROLIN user.

Ask for this demonstration or free technical literature.

Perolin
SINCE 1904

The PEROLIN COMPANY, Inc.

Manufacturing Chemists since 1904

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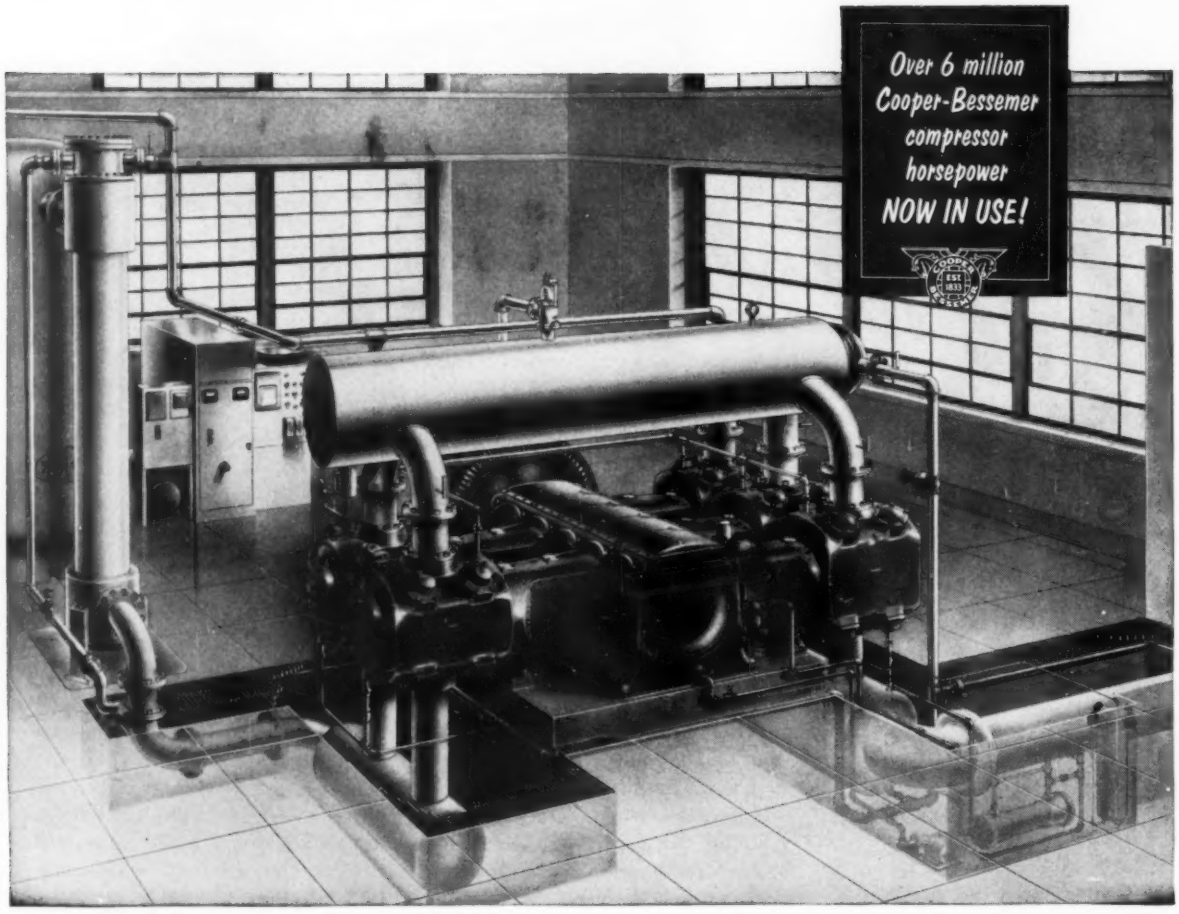
22 WAREHOUSES IN THE U.S. AND CANADA

A HALF-CENTURY OF EXPERIENCE THE WORLD OVER



Recommended setup
FOR SHOP AIR AT LOWEST COST!

THE above illustration shows a modern air compressor installation completely equipped with controls capable of functioning efficiently under all plant air requirements.

This opposed-action unit is one of the latest Cooper-Bessemer motor-driven compressor designs and is rated 1,000 hp, delivering 5,000 CFM at 100 lbs. operating pressure. The Cooper-Bessemer opposed-action design contributes to space-saving compactness, vibration-free operation and long life. Note also that in this setup pulsation dampers are located on all suction and discharge lines, and that all controls are localized on a single panel for maximum compactness and convenience. Finally, space requirements, piping and line losses are minimized with a single overhead intercooler.

Whatever your requirements for air, Cooper-Bessemer engineers will be glad to work with you and help you come up with *more air . . . in less space . . . at lowest cost.*

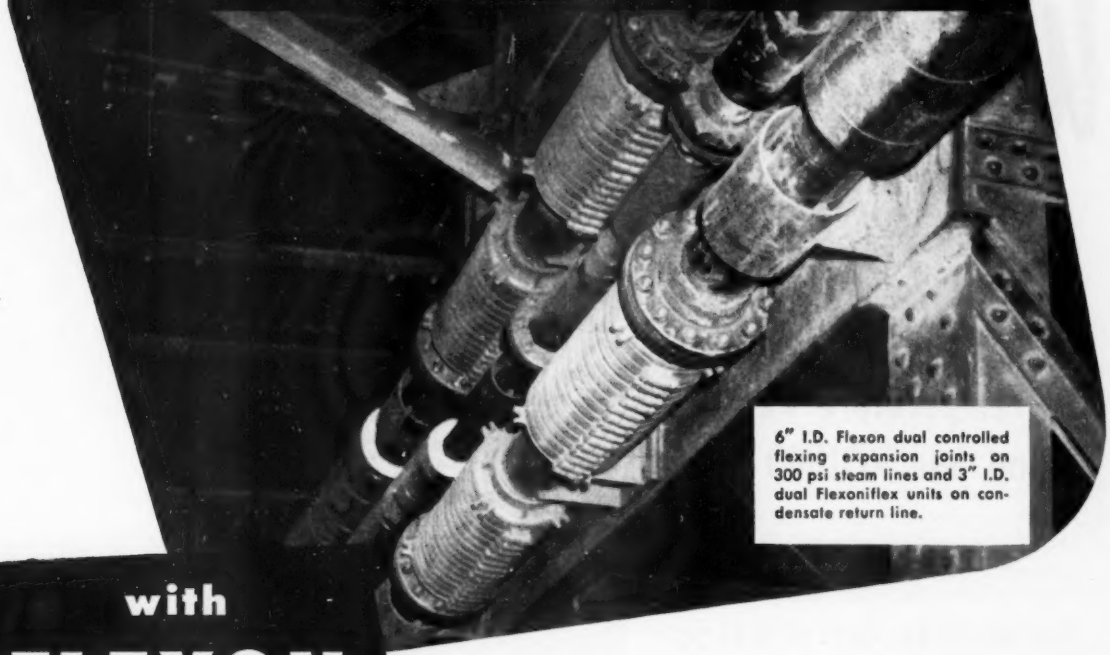
The Cooper-Bessemer Corporation

MOUNT VERNON, OHIO — GROVE CITY, PA.

New York • Chicago • Washington • San Francisco • Los Angeles • San Diego • Houston • Dallas • Odessa • Pampa • Greggton • Seattle • Tulsa • St. Louis • Gloucester • New Orleans • Shreveport
Cooper-Bessemer of Canada, Ltd., Halifax, N. S.

DIESELS • GAS ENGINES • GAS-DIESELS • ENGINE-DRIVEN AND MOTOR-DRIVEN COMPRESSORS • HIGH PRESSURE LIQUID PUMPS

CONTROL PIPELINE MOTION this dependable, maintenance-free space-saving way



6" I.D. Flexon dual controlled flexing expansion joints on 300 psi steam lines and 3" I.D. dual Flexoniflex units on condensate return line.

with FLEXON EXPANSION JOINTS

Eliminate the dangers of pipeline motion easily and permanently by installing Flexon Expansion Joints. These units are compact and easily installed. They can not leak and require no packing or maintenance of any kind. Just install them and forget them.

Flexon Expansion Joints are offered in three types—Free Flexing in copper or stainless steel for pressures to 30 psi—Controlled Flexing in copper or stainless steel for pressures to 300 psi—High Pressure Flexoniflex units in stainless steel for pressures to 5500 psi. All stainless steel pressure carriers withstand temperatures to 800° F. (1600° F. with special alloys). Copper models pressure and temperature rated according to code. All models are suitable for handling radial, axial and/or lateral pipeline motion.

Write for the name of your nearest Flexon representative.

Complete specifications on expansion joints to meet your needs are given in the new Flexon Expansion Joint Bulletin. Write for your copy today or see Flexonics Expansion Joint Catalogs in Sweet's, Chemical Engineering Catalog and The Refinery Catalog.

Flexonics Corporation EXPANSION JOINT DIVISION
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FORMERLY CHICAGO METAL HOSE CORPORATION
In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario

Flexon identifies CMH products that have served industry for over 50 years.

Flexible metal hose

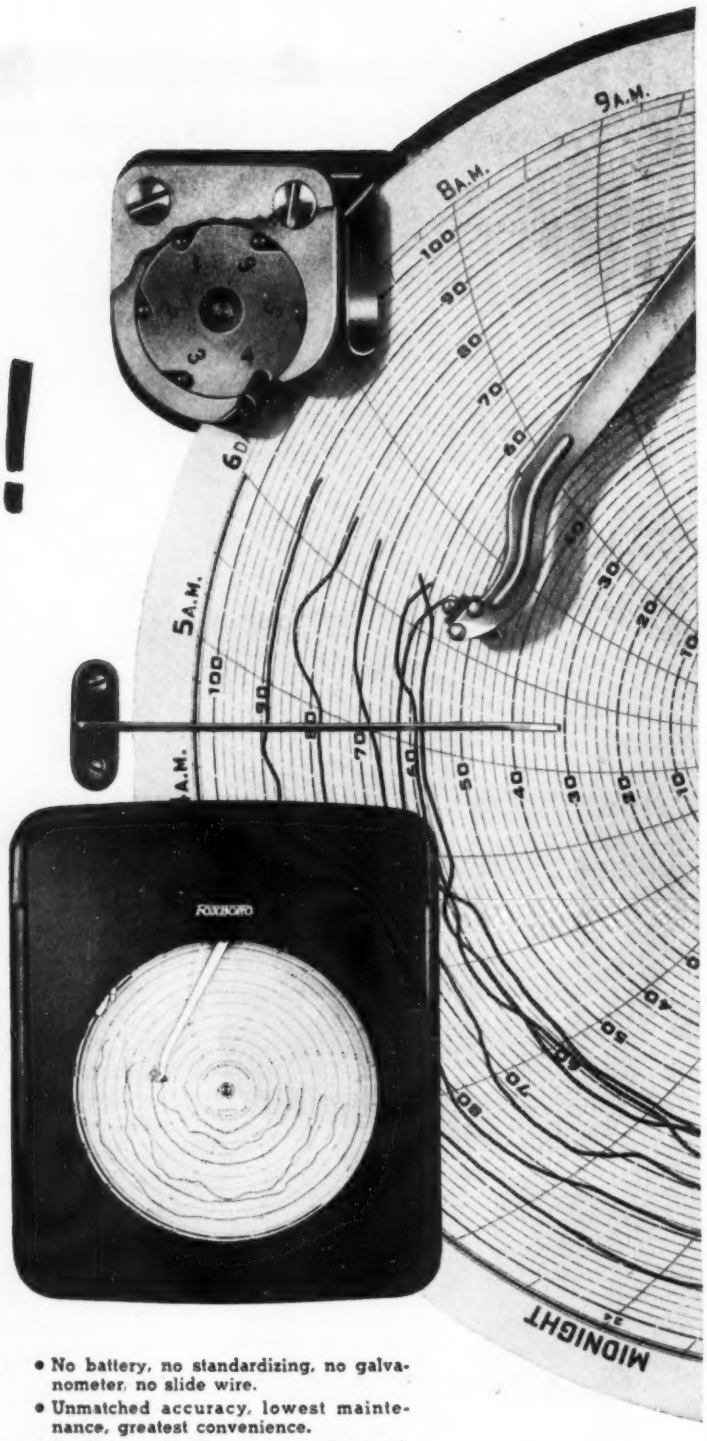
Expansion joints

Aircraft components

Metallic bellows

What a record!

...6 Color-coded Temperature Records on one ROUND Chart



THE MULTI-RECORD DYNALOG*

What convenience! What economy! You can record up to 6 related temperatures on a single *circular* chart with this Foxboro Multi-Record Dynalog. Not only saves panel space, but simplifies comparison of records. There's only one pen arm—yet all 6 records appear in different, distinctive colors. Bulletin 427-1 tells the complete story. Write for your copy. **The Foxboro Company, 682 Neponset Ave., Foxboro, Mass., U.S.A.**

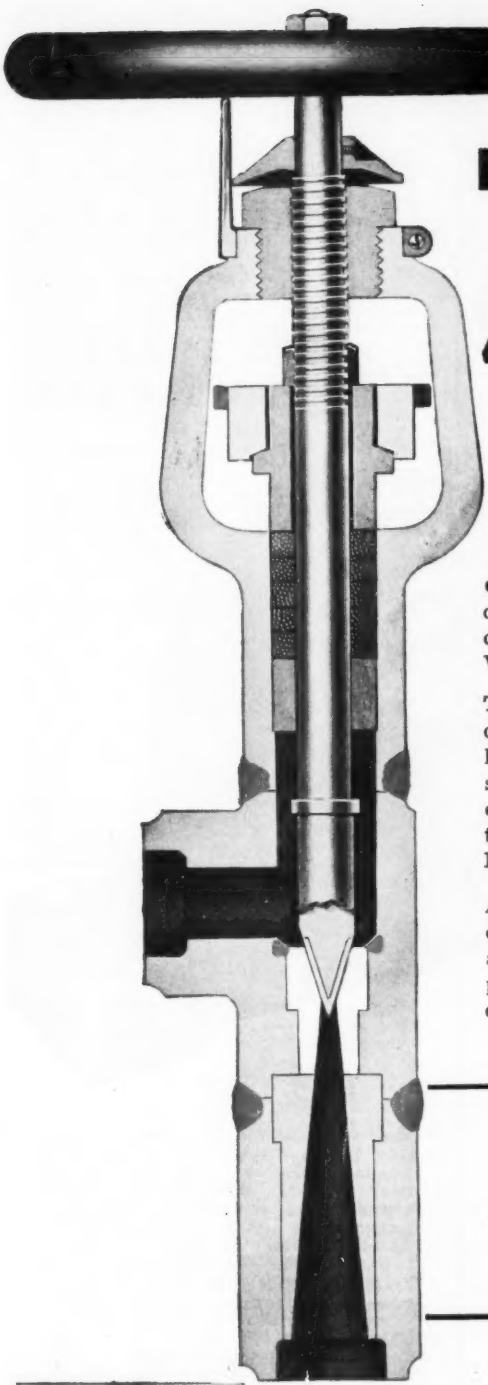
*Reg. U. S. Pat. Off

Check these outstanding features

- High speed recording—only 6 seconds between prints for quick detection of process variations.
- Uses convenient, low cost circular charts.
- Each record line has its own distinctive, non-smudging color.
- No battery, no standardizing, no galvanometer, no slide wire.
- Unmatched accuracy, lowest maintenance, greatest convenience.
- Available with alarms or on-off control.
- Thermocouple or resistance-bulb types.

FOXBORO REG. U. S. PAT. OFF. — MULTI-RECORD DYNALOG

FACTORIES IN THE UNITED STATES, CANADA, AND ENGLAND



BUILT TO WITHSTAND *Flashing Steam...*

HANCOCK
HI-PRESSURE DROP
WELDVALVES

CONTINUOUS BLOWDOWN can wreck a conventional valve seat in a few days or weeks, regardless of pressure or temperature. Avoid the high cost of such quick destruction — specify Hancock Hi-Pressure Drop Weldvalves. They combine orifice, shut-off and index in a single unit.

The inlet of these blowdown valves is above the seat. The diverging delivery tube provides a rim for the flashing steam and compels the high-velocity stream of water to dissipate its force upon itself, instead of destroying the valve. This ingenious design assures long, economical life in continuous blowdown service. Because they are of the orifice type, you can use a smaller size valve with a large capacity. Intermediate capacities obtainable by adjusting the valve opening.

Ask for complete data on Hancock Hi-Pressure Drop Weldvalves for continuous blowdown systems. Also learn how these rugged valves are used on feed water pump bypass relief, in turbine washing processes, and in other services where corrosion is severe and conventional valves wear rapidly. Write or phone today.

HANCOCK HI-PRESSURE DROP WELDVALVES
NO BONNET JOINT DESIGN

Sizes: ¾", 1", 1½".
Orifice Sizes: Minimum ⅛"
Maximum 1"

Pressures: 600 p.s.i. thru 2500 p.s.i.

Connections: Screwed or socket weld ends.

Seats: 500 Brinell Stainless Steel or Solid Stellite. Venturi throat silver brazed to the body.

Steam-Disc: Integral needle point—500 Brinell Stainless Steel or tipped with Stellite.

When Hancocks go in, valve costs go down.

HANCOCK VALVES

A product of **MANNING MAXWELL & MOORE, INC.** WATERTOWN 72, MASSACHUSETTS

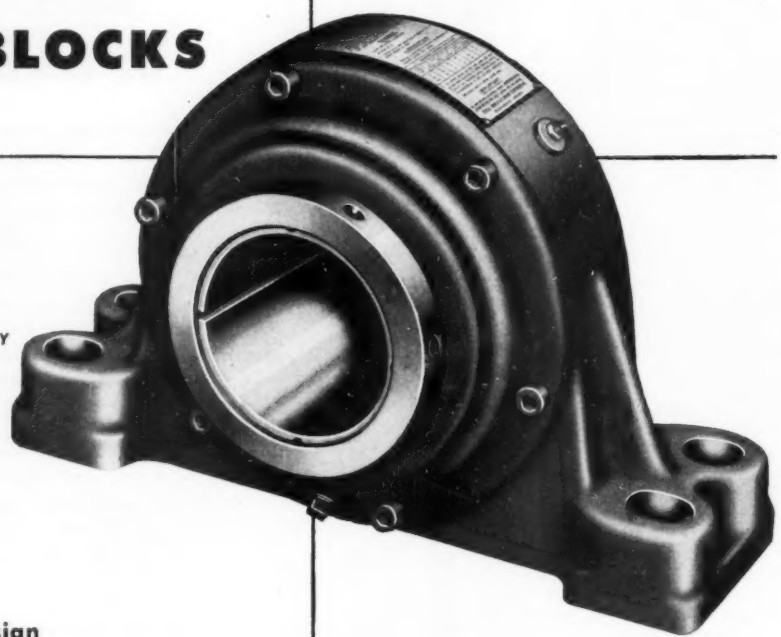
MAKERS OF 'HANCOCK' VALVES, 'ASHCROFT' GAUGES, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN' INDUSTRIAL INSTRUMENTS. BUILDERS OF "SHAW-BOX" CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES.

NEW

DODGE-TIMKEN ALL-STEEL PILLOW BLOCKS

HEAVY DUTY CAPACITY!

LESS SPACE! LESS WEIGHT!



A JOINT ENGINEERING DEVELOPMENT BY DODGE AND THE TIMKEN ROLLER BEARING COMPANY

- All-Steel construction
- A new Timken bearing design
- High radial and thrust capacities
- Compact—minimum dimensions
- Minimum weight with maximum strength
- Fully self-aligning with spherical outer race
- Both expansion and non-expansion types
- Adapter mounting, proven through the years
- Double piston ring seals
- Sealed both on and off the shaft
- Fully assembled, permanently adjusted, lubricated and sealed at the factory

Here are the bearings for industry's toughest jobs. High radial and thrust capacities. Stamina to take heavy shock loads. And all-steel construction packs this load-carrying capacity into less weight and less space. Engineers are already specifying "Dodge-Timken All-Steel" for some of America's largest projects. Write for details and delivery dates, or call your Dodge Distributor.

DODGE MANUFACTURING CORPORATION
3200 Union Street, Mishawaka, Indiana

CALL THE TRANSMISSIONEER, your local Dodge Distributor. Factory trained by Dodge, he can give you valuable assistance on new cost-saving methods. Look for his name under "Power Transmission Equipment" in your classified phone book.

DODGE
of Mishawaka, Ind.

NAME PLATES

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, CHICAGO THRIFT-ETCHING CORPORATION, 1555 SHEFFIELD AVENUE, CHICAGO 22, ILLINOIS

WHAT MUST YOU HAVE

... IN POWER PIPING?

Above all other things, you must have CONFIDENCE in it.

Confidence can't be purchased—it is acquired only through complete belief in the pipe fabricator's skill, facilities, technical knowledge . . . and *experience.*

P. P. & E. has been fabricating all types of high-pressure, high-temperature piping for central stations, paper mills, process and industrial plants for almost half a century. The importance of this experience, to you, is its great value in avoiding errors of omission and commission which can result in inefficiency, damage to expensive equipment, and dangerous operating conditions.

When P. P. & E. does the job, utmost care is taken to evaluate and interpret specifications correctly, and to comply strictly with code and insurance company requirements. Highly specialized shop facilities for bending, welding, Van Stoning, machining, heat-treating, testing, and inspection have been developed, and are operated by skilled workmen under competent supervision. A trained field organization directs the installation of complete systems, extensions, or alterations to existing layouts in any part of the country.

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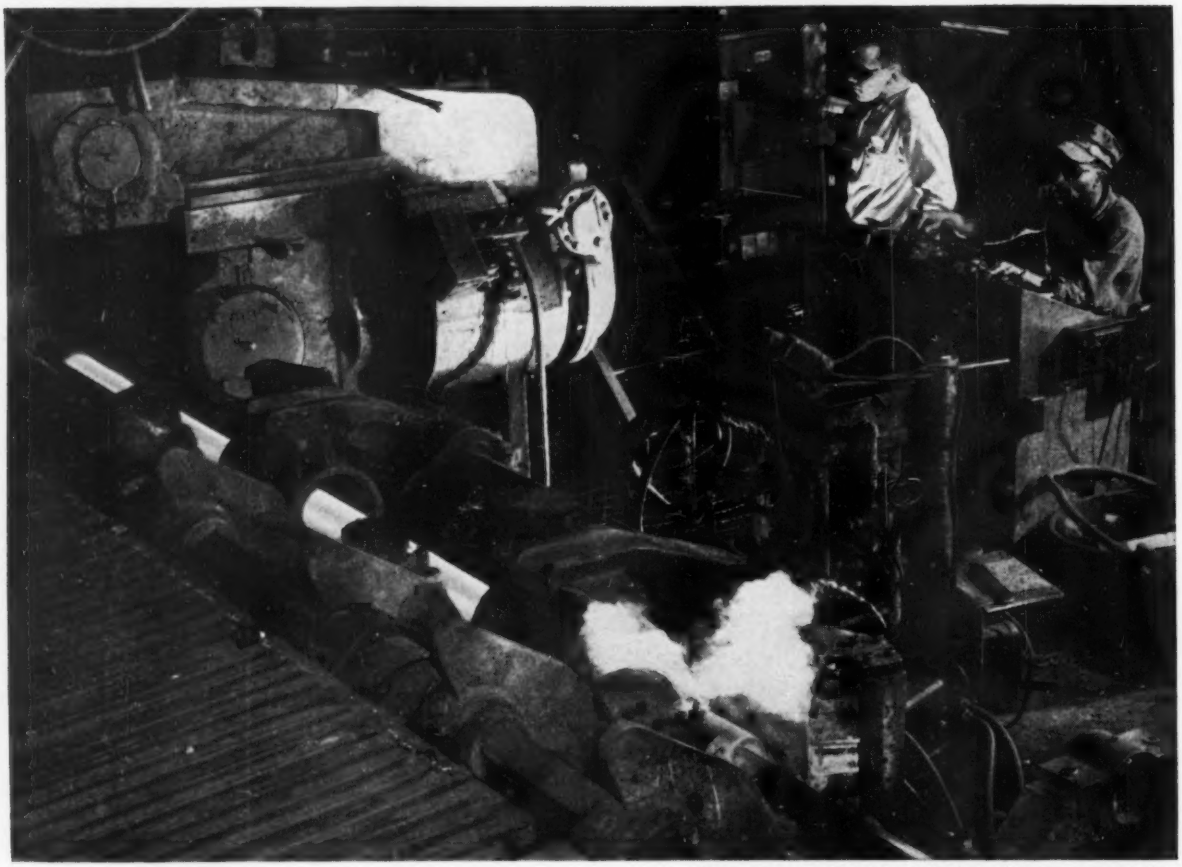
Pittsburgh Piping

AND EQUIPMENT COMPANY

10 Forty-Third Street—Pittsburgh, Penna.

Quality begins with the billet . . .



Here is one of the highly specialized manufacturing operations that insure Globe quality — piercing the billet to form a seamless tube.

only GLOBE welding fittings receive continuous specialized process control from billet, to tube, to fitting

The quality of any welding fitting cannot exceed the quality of the tube from which it is fabricated.

Only Globe — among manufacturers of fittings — produces its own seamless tube. *Specialized* processes at every stage of manufacture — from billet . . . to tube . . . to fitting — insure uniform high quality. Rigid inspection and continuous laboratory controls guarantee strict conformity to rigid specification.

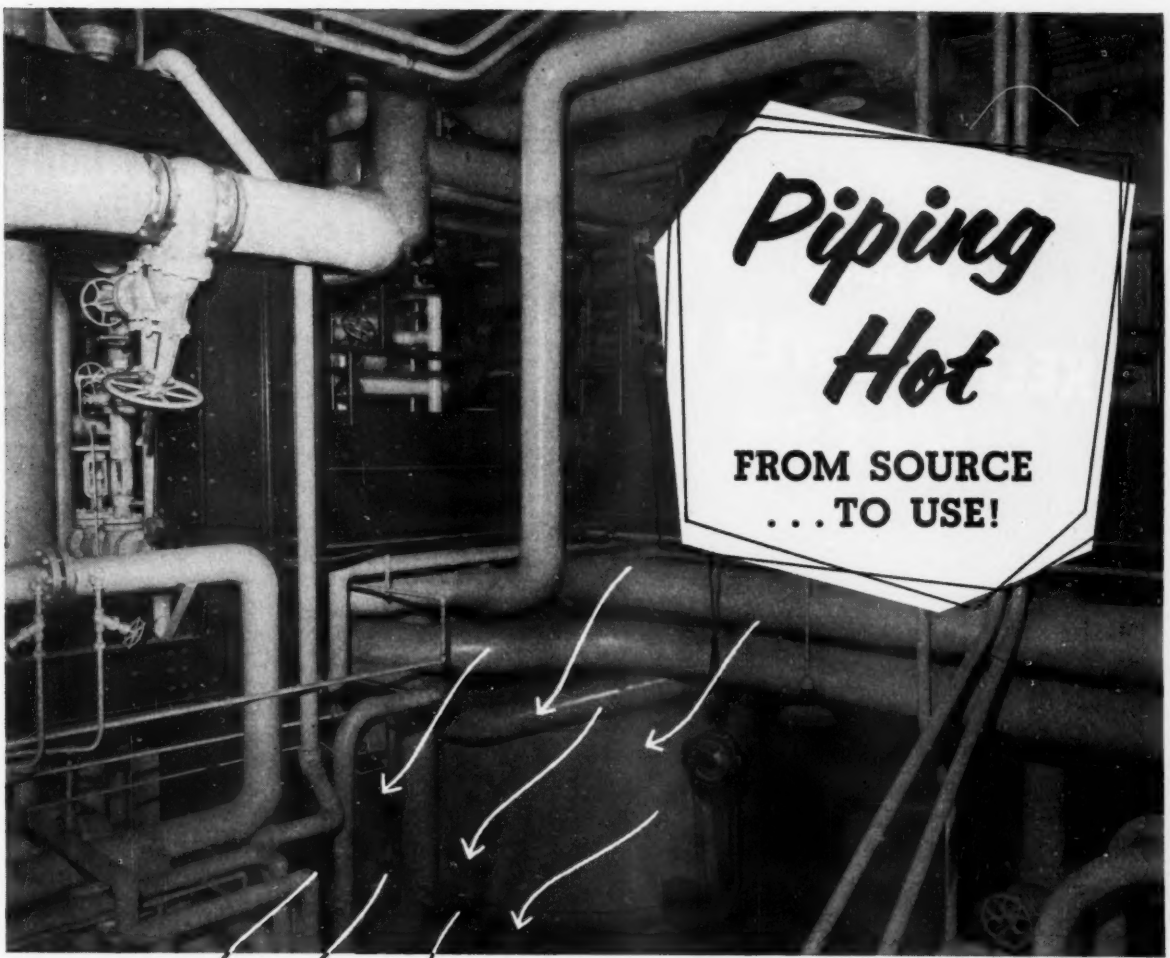
Moreover . . . *you can get these high-quality fittings now* — when you need them. Just get in touch with your nearest Globe Sales office.

For complete information on the finest welding fittings available anywhere, send for the Globe Welding Fittings Catalog.

GLOBE STEEL TUBES CO., Milwaukee 46, Wisconsin

Chicago • Cleveland • Detroit • Houston • New York • Philadelphia
St. Louis • Denver • San Francisco • Glendale, Cal.

Producers of Globe seamless stainless steel tubes — Gloweld welded stainless steel tubes — alloy — carbon — seamless steel tubes — Globeiron (high-purity ingot iron) seamless tubes — Globe Welding Fittings.

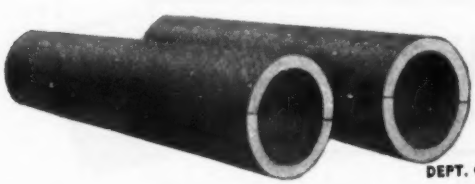


UNARCO

Unibestos®

PIPE INSULATION

for Temperatures up to 1200°F



High thermal efficiency! That's one of the features of Unibestos Pipe Insulation. It's an outstanding b.t.u. barrier.

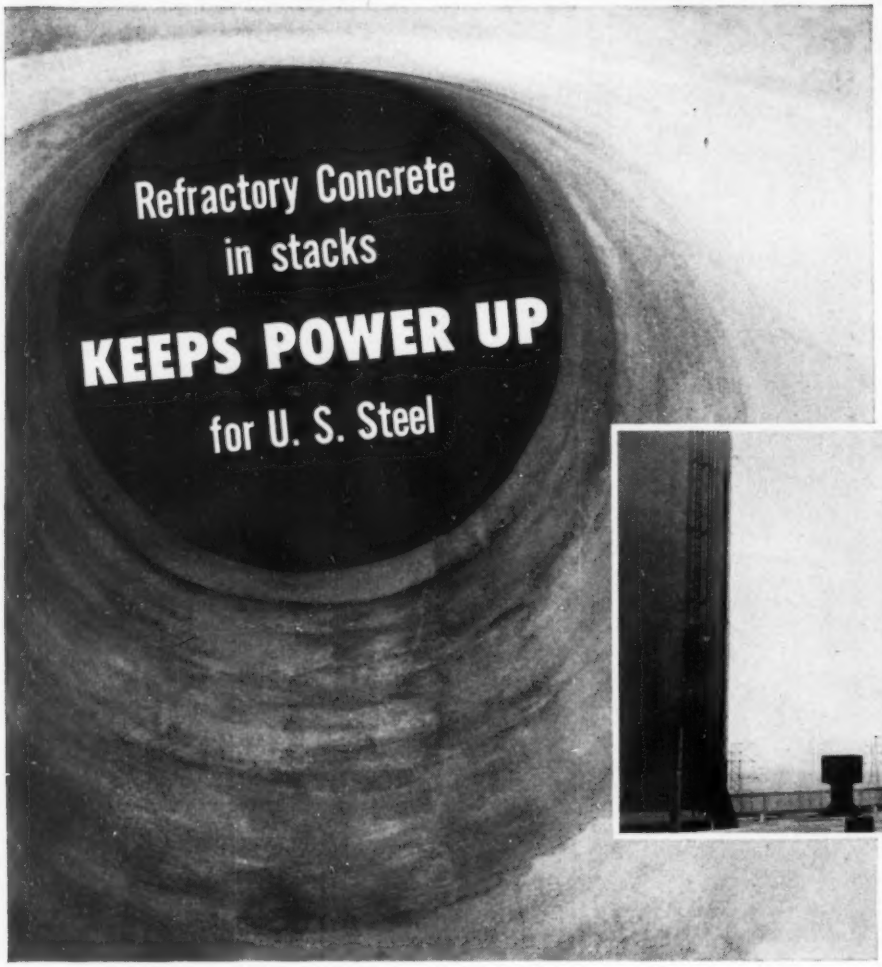
Yes, and it's easy to fit—cuts quickly, cleanly. And Unibestos lasts and lasts because it's highly resistant to moisture, fumes, vibration, and impact.

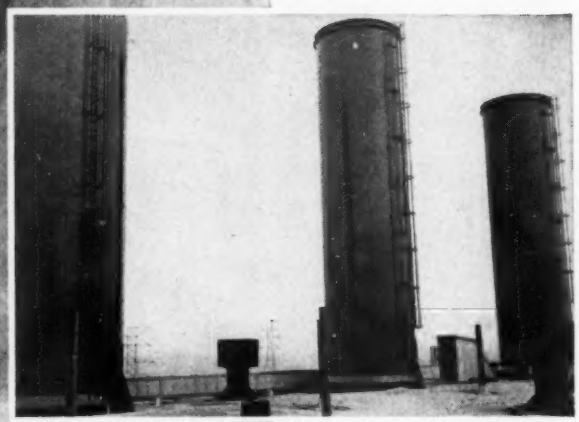
That's why you're finding more Unibestos in more plants every day. It's made in cylinders and half-rounds in two types: No. 750 for temperatures up to 750°F.; No. 1200 for up to 1200°F. And it's also available in block-form for up to 1200°F. uses.

Phone your nearby Unarco Distributor for recommendations and prompt service on Unibestos, Amocel, and other dependable Unarco insulations. For new installations or replacements, there's nothing better.

UNION ASBESTOS & RUBBER CO.

DEPT. C-2, 332 SOUTH MICHIGAN AVENUE • CHICAGO 4, ILL.





FAST WORK—Each 14′ 10″ i.d. x 61′ 6″ high stack got a 2½″ lining of Refractory Concrete in just 4 days after reinforcing wire mesh was attached. Concrete made with Lumnite Cement and traprock was "shot" on by cement gun.

You're looking down

the smooth, jointless Refractory Concrete lining that protects a power stack at the new Fairless Works. It's the way U. S. Steel assures long, trouble-free stack life. Here's why:

Saves time. Fast, monolithic construction is further speeded by the ability of Refractory Concrete made with Lumnite* Cement to reach service strength in 24 hours or less! *Helps draft.* The one-piece lining prevents "breathing." *Gives long-lasting protection.* Lumnite-made Refractory Concrete resists attack of sulphurous gas and abrasive fly ash, takes heat to 2600°F, has low volume change and withstands thermal shock.

Whether you're lining or rebuilding a stack, it will pay you to look into the enviable record of Refractory Concrete made with Lumnite calcium-aluminate cement—in power, metals and refining industries . . . in fact, wherever heat, corrosion or abrasion are problems.

FOR CONVENIENCE, you may prefer to make Refractory Concrete with prepared castables (Lumnite Cement plus aggregates selected for specific temperature and insulation service—add only water). They're made by refractory manufacturers and sold through their dealers. For more information, write Universal Atlas Cement Company (United States Steel Corporation Subsidiary), 100 Park Avenue, New York 17, N. Y.

**"LUMNITE" is the registered trade mark of the calcium-aluminate cement manufactured by Universal Atlas Cement Company.*

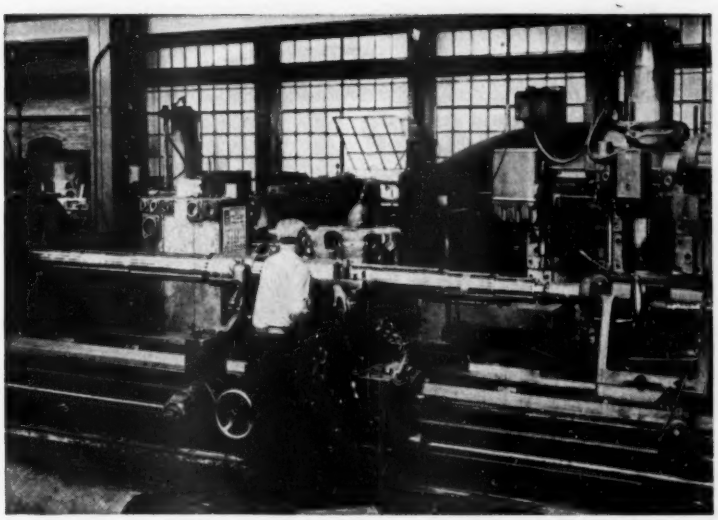
P-L-74

ATLAS® **LUMNITE for INDUSTRIAL CONCRETES**

REFRACTORY, INSULATING, OVERNIGHT, CORROSION-RESISTANT

"THE THEATRE GUILD ON THE AIR"—*Sponsored by U. S. Steel Subsidiaries—Sunday Evenings—NBC Network*

When you need a tough, fatigue- and corrosion-resisting alloy —try "K" Monel



This is the largest INCO Nickel Alloy pump shaft in the world. The shaft is 13 feet 7⅛ inches long, 9.005 inches at its widest diameter, and weighs 3,343 lbs. It was forged by INCO'S Huntington Mill from "K" Monel for Consolidated Edison Co., after other materials repeatedly failed. Neither "K" Monel nor Monel have ever been known to fail from corrosion fatigue in salt water.

Are there applications in your operation where metal is subject to fatigue, corrosion and erosion?

Then chances are "K" Monel is the alloy you need.

"K" Monel is a tough, corrosion-resisting wrought alloy of Nickel, copper and aluminum. It offers you the excellent corrosion resistance of regular Monel, together with the added advantages of greater stiffness and hardness through heat treating.

As evidence of the value of "K" Monel's added advantages, take a pump shaft operating in highly corrosive and polluted salt water.

New York City's Consolidated Edison Company has two big 80,000-gallon-per-minute condenser circulating water pumps. For years engineers kept replacing the shafts with materials of increasing strength but failures would continue to occur in the same spot because of corrosion fatigue.

Finally, they decided to try "K" Monel.

A 1½-ton heat-treated "K" Monel shaft with a tensile strength of 140,000 pounds per square inch was installed in September of 1949 and has been functioning perfectly ever since. In fact, the pump casing has not even been opened for inspection since installation.

Let's take a quick look at a few of the principal characteristics of "K" Monel:

Age-hardenable, or capable of having its hardness and mechanical properties increased simultaneously as the result of thermal treatment, "K" Monel is equal in strength and toughness to many heat-treated alloy steels. It shows improved strength and hardness at sub-zero temperatures with no loss of toughness. And it provides moderate strength at temperatures up to 900° F.

"K" Monel is non-magnetic under ordinary conditions, and remains so down to —150° F.

The working characteristics of "K" Monel are excellent, too. It is readily machined in an annealed condition, but in other conditions may be considered commercially machinable at practical (although generally somewhat slower) rates. It can be joined by the usual welding, brazing and soldering processes.

You'll find all essential engineering data on "K" Monel and its more machinable companion alloy, "KR" Monel, in the 24-page reference manual, "Engineering Properties of 'K' Monel and 'KR' Monel." Write for your copy.

One last—and important—point. "K" Monel, like other INCO Nickel Alloys, is now on extended delivery because of defense needs. So it is important to include NPA rating and complete end-use information with all orders.

The International Nickel Company, Inc.

67 Wall Street, New York 5, N. Y.

Nickel INCO TRADE MARK Alloys

MONEL® • "R"® MONEL • "K"® MONEL
"KR"® MONEL • "S"® MONEL • NICKEL • LOW CARBON NICKEL • DURANICKEL® • INCONEL®
INCONEL "X"® • INCOLOY • NIMONICS®

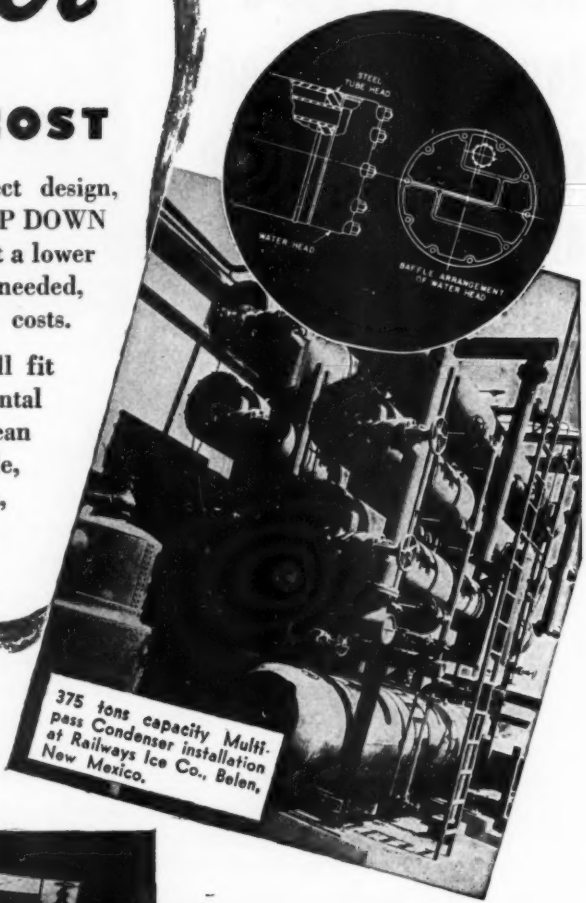
$ave Power and REFRIGERATION COST

Vogt Condensers, because of their correct design, STEP UP the rate of heat transfer and STEP DOWN head pressures. With the liquid delivered at a lower temperature, smaller compressor capacity is needed, saving in original as well as operating costs.

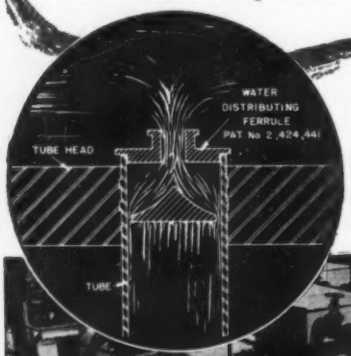
One of the two basic types illustrated will fit your operations exactly. Install Horizontal Multipass (closed type) for use with clean waters. Where the water is hard, forms scale, contains mud or promotes fungus growth, Vertical Single Pass (film type) which can be cleaned in operation, are recommended.

Horizontal Multipass Condensers
(Closed Type)

Water circulated in tubes traverses the length of the unit a number of times as determined by baffles in the heads.

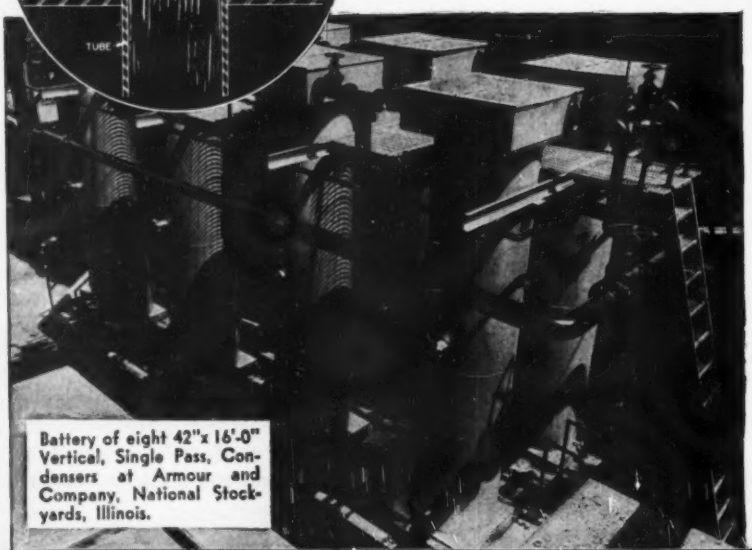


375 tons capacity Multipass Condenser installation at Railways Ice Co., Belen, New Mexico.



Vertical Single Pass Condensers
(Film Type)

Patented ferrules give equal distribution of water to and over the surfaces of all tubes in a unit.



Battery of eight 42"x 16'-0" Vertical, Single Pass, Condensers at Armour and Company, National Stockyards, Illinois.

HORIZONTAL and VERTICAL TYPES SHELL and TUBE CONDENSERS For Every Service

Write For Bulletin RC-1

HENRY VOGT MACHINE COMPANY
INCORPORATED
1000 W. ORMSBY ST., LOUISVILLE 10, KY., U.S.A.
Branch Offices: NEW YORK, CHICAGO, CLEVELAND, DALLAS, PHILADELPHIA, ST. LOUIS, CHARLESTON, W. VA.

Vogt REFRIGERATION CONDENSERS

Free Engineering Data

on BOILER FEED and CONDENSATE RETURN SYSTEMS

Information That is Often Hard to Find When You Need it . . . Get it Now and Keep it Handy

This information belongs in your files It will be of inestimable help to you when planning or specifying systems or components to do specific jobs most efficiently. Included are complete engineering data and specifications on:

ENGINEERING BULLETINS

"A Discussion of Deaerator Design Principles," covering design intent, basic requirements, and other considerations. *Engineering Bulletin 570.*

Engineering Notes for Storage Hot Water Heaters. How to determine the proper heater for specific applications. *Engineering Bulletin No. 911.*

ENGINEERED CONDENSATION DRAINAGE AND AUTOMATIC BOILER FEED SYSTEMS:

Standard boiler return systems—Pree-Heet Systems—Heat reclaim systems—Spray type deaerating systems—Zero oxygen deaerating systems. *Catalog 55-A.*

QUIK-TEMP HEATING SYSTEMS:

A method of continuous steam circulation and air removal that permits machines to heat almost instantly and keeps them hot with minimum effect from load change. Increases production potential 10% or more. *Bulletin 548-B*

MAGNETROL BOILER WATER LEVEL CONTROLS:

Transmits changes in water level to the switching mechanism by magnetic action. Simple, fool-proof, positive. May be used for fuel cut-off and alarm, cut-off only or alarm only. Models for all steam pressures up to 600 pounds. *Catalog Section 111.*

CONDENSATE RETURN SYSTEMS:

Low-cost prefabricated type and heavy duty knockdown type. Featuring Master-Bilt maintenance-free pumps—Chromasoid receivers, warranted for 10 years against internal corrosion failure—Magnetrol controls. *Bulletin 655.*

CHROMASOID LINED HOT WATER STORAGE HEATERS:

Featuring Chromasoid lined tanks guaranteed against corrosion failure from any kind of water for 10 years. *Bulletin 910.*

"DRAINTROL" FOR CONTROLLED CONDENSATION DRAINAGE:

Replaces steam traps. Enables higher surface temperatures by continuous condensation drainage and air removal. *Bulletin 642.*

FRED H. SCHAUB ENGINEERING CO.
2107 SO. MARSHALL BLVD.
CHICAGO 23, ILLINOIS

FRED H. SCHAUB ENGINEERING CO.
2105 S. Marshall Blvd., Chicago 23, Ill.

Please send me the bulletins checked below:

- ☐ Catalog 55-A
- ☐ Bulletin 548-B
- ☐ Catalog Section 111
- ☐ Engineering Bulletin 570
- ☐ Bulletin 655
- ☐ Bulletin 910
- ☐ Bulletin 642
- ☐ Engineering Bulletin 911

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

"she might have been my kid..."

"There was no time to stop, see? She comes running out from behind this parked car right under my wheels. Her hair is in pigtails, and with the sun shining on it, she might have been *my* kid. We got her to the hospital. It took 3 pints of blood to bring her around. All I have to do is remember the sound of those screaming tires—and I know why *I'm* giving blood."

Yes, all kinds of people give blood—truck drivers, office workers, salesmen. And—for all kinds of reasons. But whatever *your* reason, this you can be sure of: Whether your blood goes to a local hospital, a combat area or for Civil Defense needs—this priceless, painless gift will some day save an American life!

Business Executives!
✓Check These Questions!

If you can answer "yes" to most of them, you—and your company—are doing a needed job for the National Blood Program.

- ☐ Have you given your employees time off to make blood donations?
- ☐ Has your company given any recognition to donors?
- ☐ Do you have a Blood Donor Honor Roll in your company?
- ☐ Have you arranged to have a Bloodmobile make regular visits?
- ☐ Has your management endorsed the local Blood Donor Program?
- ☐ Have you informed your employees of your company's plan of co-operation?
- ☐ Was this information given through Plant Bulletin or House Magazine?
- ☐ Have you conducted a Donor Pledge Campaign in your company?
- ☐ Have you set up a list of volunteers so that efficient plans can be made for scheduling donors?

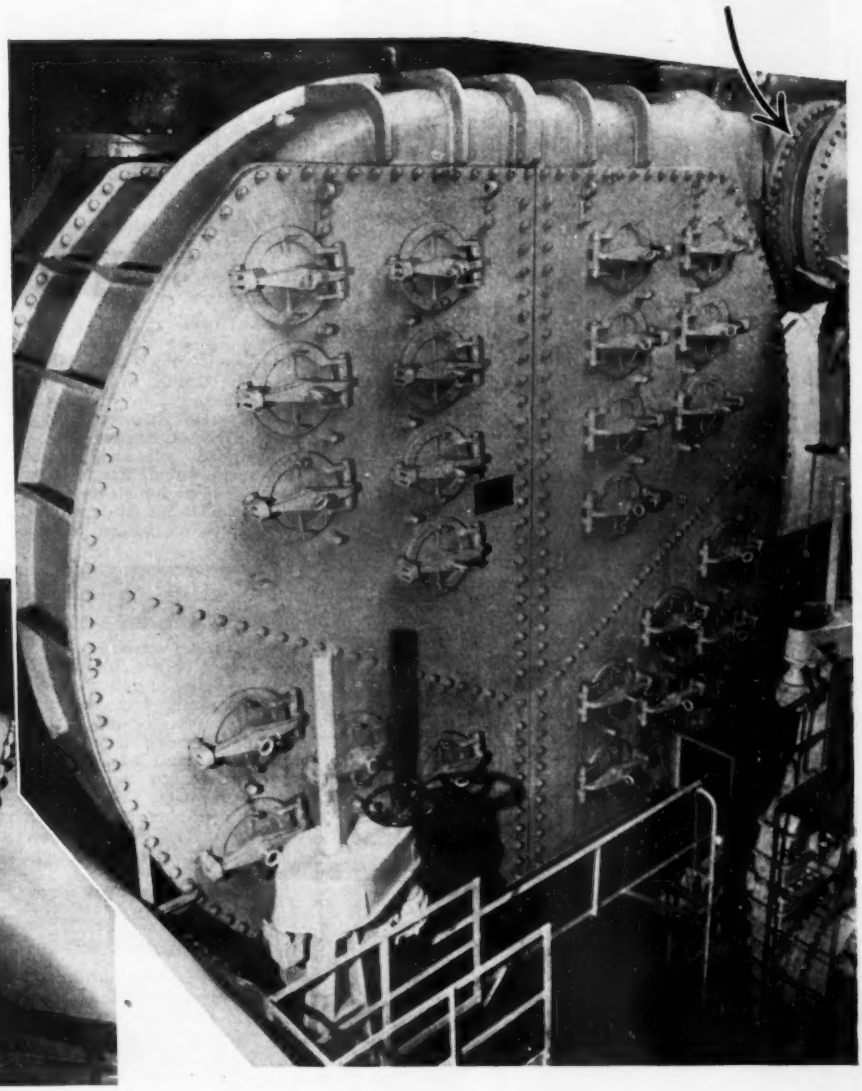
Remember, as long as a *single* pint of blood may mean the difference between life and death for *any* American . . . the need for blood is *urgent!*

Give Blood Now

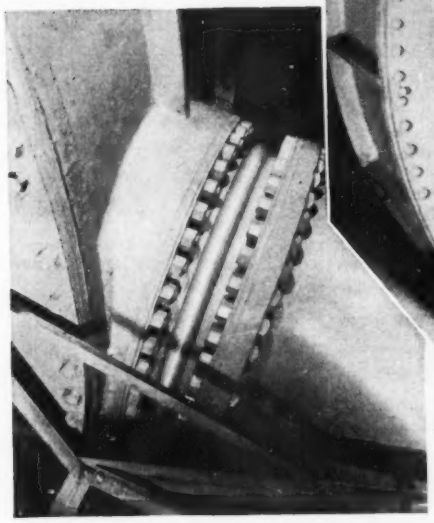
CALL YOUR RED CROSS TODAY!

NATIONAL BLOOD PROGRAM

After 20 years, the same U. S. Rubber Expansion Joints still protect this condenser



Main power plant condenser, showing 72" U. S. Rubber expansion joint on discharge pipe at upper right. Lower photograph shows close-up of 42" expansion joint on intake connection.



That's a long time in any industry. This southeastern power plant still gets perfect service from these U. S. Expansion Joints. Pipes are protected from expansion and contraction and the effects of vibration. It's easy to see why this plant, like so many others throughout the nation, uses "U. S." Expansion Joints exclusively. Let U. S. Rubber engineers help you handle your expansion joint problems.

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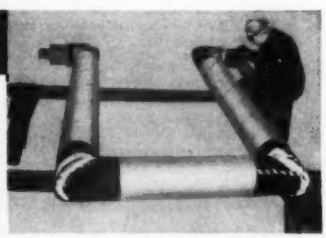

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Fig. 559—125-pound Iron Body Bronze Mounted Swing Check Valve with flanged ends, bolted flanged cap and regrindable, renewable bronze seat and disc.

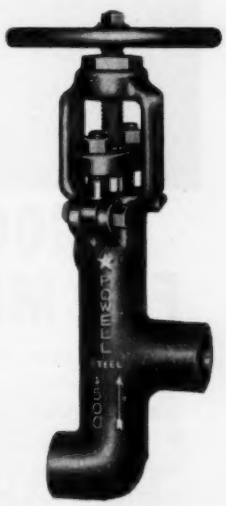

Fig. 1331-A — Steel Integral Bonnet Offset Globe Valve with socket weld ends. For 1500 pounds W.P. Sizes ½" to 2", inclusive.

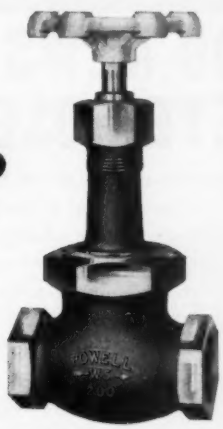

Fig. 2608—200-pound Bronze Globe Throttling Valve that permits FULL FLOW through seat, thus reducing turbulence and pressure drop to the minimum. Special bronze stem and stainless steel disc and seat hardened to approximately 500 Brinell.

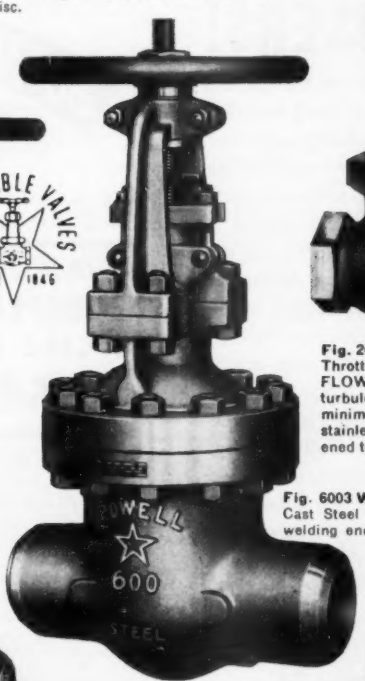

Fig. 6003 W. E.—600-pound Cast Steel Gate Valve with welding ends.

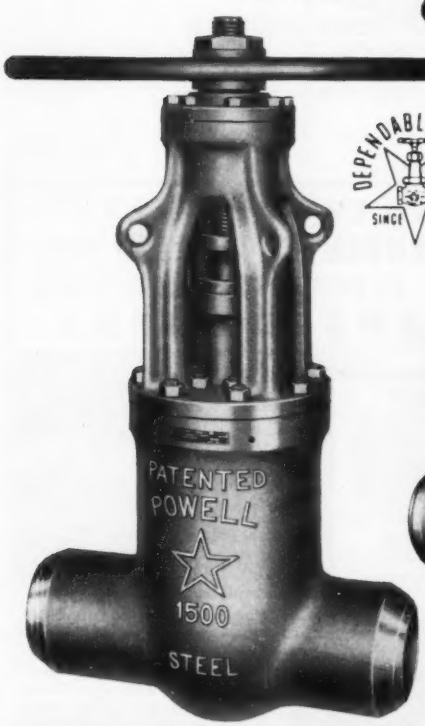

Fig. 11303 W. E.—1500-pound Cast Steel Pressure Seal Gate Valve with welding ends.

Fig. 1314-A—1500-pound Steel Integral Bonnet "Y" Valve with socket weld ends. Available in sizes ½" to 2", inclusive.

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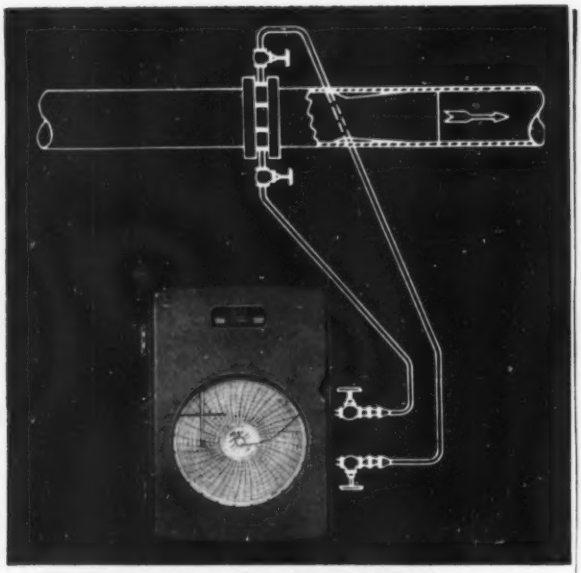

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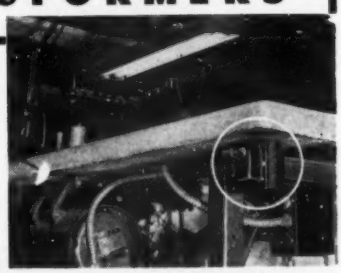
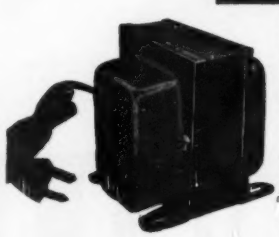


• Acme Stepdown Transformers are available in standard ratings from 75 to 2000 watts. Ready for easy installations.



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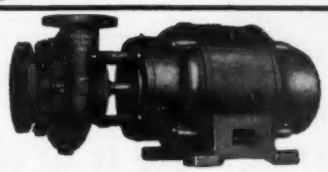

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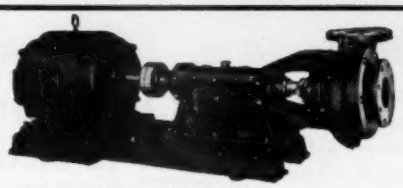
for pressures up to 500 psi, any temperature. Rugged, efficient, popular boiler feed pumps. Bulletin 980. "Buffalo" also manufactures automatic condensate pump and receiver units.



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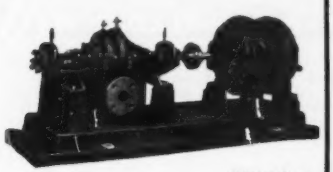

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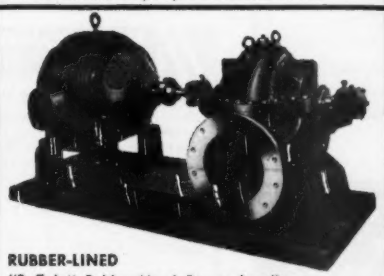

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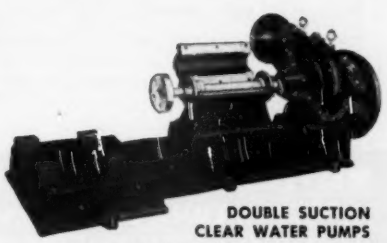

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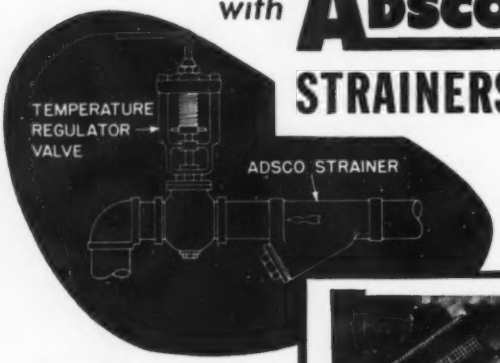

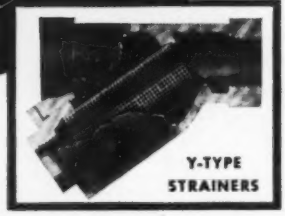

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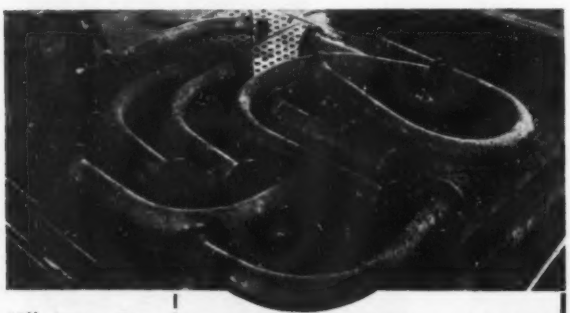

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PROSPERITY IN THE USA: How Wealthy Are We?

Again, how prosperous *are* the people of the United States?

This is the third of a series of messages devoted to this crucially important and much-debated question. The first two messages dealt with what has been happening to our national income, both in terms of its growth and how it is divided among individuals.

This third message deals with what has been happening to the resources—factories, farms, mines, and equipment of all kinds—out of which income is created. It deals with what economists call our wealth.

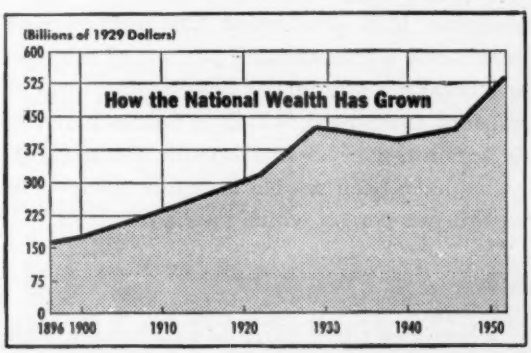
It is possible for a nation to enjoy apparent prosperity for a time by rapidly exhausting its resources. But to sustain prosperity over the long pull a nation must see that its wealth is not dissipated. Hence what is happening to our wealth now is a harbinger of what is going to happen to our prosperity later on.

How Wealth is Measured

It is often asserted that the most vital element in a nation's wealth is its people. There is a lot in this idea. For example, the full value of a country's hospital and surgical equipment depends on its physicians and their skill in handling the equipment.

However, no one has ever devised a satisfactory way to put a value on human beings. So people are omitted from calculations of national wealth. So, too, is military equipment. It is regarded as basically destructive and hence not a real addition to wealth. Otherwise, the wealth of a nation is calculated in terms of the dollar value of its physical resources.

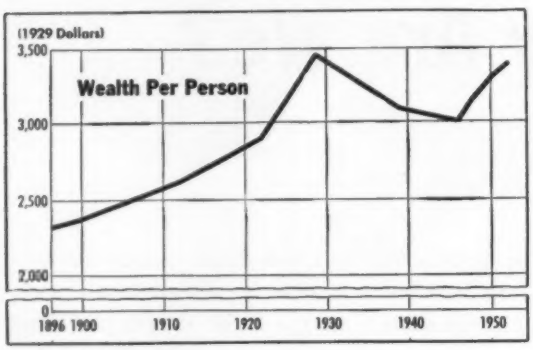
The following chart shows the wealth of the U.S.A. at various intervals during the past 50 years. For the period through 1948 the figures come from a pioneering study by Raymond Goldsmith of the National Bureau of Economic Research, which is widely regarded as the foremost organization in its field. The figures since 1948 are estimated. To remove the effect of price changes, all of the wealth figures are calculated in 1929 prices.



From this chart one fact stands out clearly. It is that since 1929 our national wealth has not been increasing as steadily as it did during

earlier periods. Indeed, in 1946 our total national wealth was actually less than it was in 1929. Only in the last six years have we been able to make any consistent additions.

Even these gains are less impressive when the growth in our population is taken into account, as illustrated by the following chart.



This chart makes it clear that when the nation's wealth is divided by the population, we are slightly worse off per person today than we were in 1929. This is the case in spite of the large additions to our national wealth since 1946.

Depression and war are the two principal reasons we have made no progress in increasing our wealth per person since the 1920s. The depression brought mass unemployment and greatly reduced production which ruled out any increase in wealth. During World War II and again during the post-Korean mobilization program, U.S. production has reached new peaks. But a considerable portion of this record breaking output has been in the form of military equipment, which is not included in an accounting of national wealth. Consequently, we have been unable to regain the level of wealth per person which we had in 1929.

A Brake of Prosperity

What does this failure to raise our wealth per person mean? It means that we have fewer resources with which to create income for each individual. It means that we have made no progress in the crucial task of assuring future increases in prosperity.

As the second editorial in this series demonstrated, we have gone so far in equalizing individual incomes that "the possibilities of increasing the income of the rest of the people by 'soaking the rich' have largely disappeared." From now on the only promising way to increase our individual incomes is to increase our national earning power.

During the past four years it has taken about $3.60 of national wealth to yield $1 of income after taxes. This is a low figure for the wealth needed. Prior to World War II there were long periods when it took at least $5 of national wealth to produce $1 of national income. The experts in this field are by no means certain that it will not again take $5 rather than $3.60 of wealth to increase income by $1.

But let us assume that $3.60 of wealth will suffice to provide $1 of income in the years ahead. If by 1960—seven years from now—the income of the average American is to be increased from about $1490, where it stands at present, to $2000, we must add $310 billion to the national wealth. This is nearly three times as much as we have added to our wealth since the end of World War II, seven years ago.

Because we have made large additions to our productive equipment in recent years, fears are frequently expressed that we shall soon be plagued by an excess of such equipment. But the facts about our national wealth do not support this conclusion. They indicate that we still have ahead of us a tremendous job of increasing our resources if the American standard of living is again to resume the steady climb which was interrupted by depression and war.

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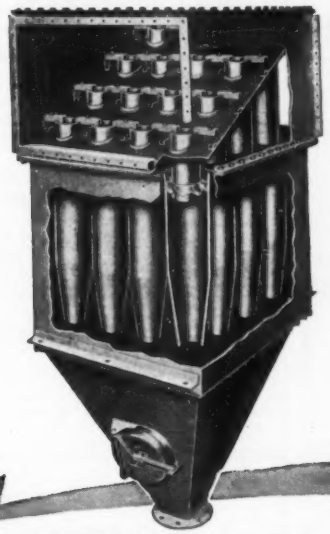

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Because the advantages of MULTICLONE are so clear-cut, so vitally important, so far-reaching in the savings they make, we urge you to make a factual unbiased comparison of MULTICLONE fly ash collection equipment against *any other* in the mechanical recovery field. Only by making such a comparison can you fully appreciate the major savings and greater performance you get by installing MULTICLONE Collectors!

COMPARE Recovery Efficiency!

It is a recognized fact that the separating efficiency of a cyclonic tube *increases* as the tube diameter *decreases* because smaller tubes generate greater centrifugal forces. The patented vane in the MULTICLONE makes the use of small tubes *practical* without complicated manifolding and permits compacting many small tubes into one simple, highly efficient unit. MULTICLONE's higher centrifugal forces throw out not only the large, medium and small particles, but also an unusually high percentage of the *extremely small* particles of 10 microns and less. Result—*more complete recovery of all suspended particles from the gas stream!*

COMPARE Space-Saving Compactness!

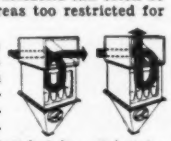
Plant space costs money—particularly at today's high construction costs. Because the MULTICLONE is more compact, size for size, it makes *really important* savings in space and plant costs. Note in the chart how the MULTICLONE requires substantially less space—*both in floor space and cubic space*—than any other unit of comparable capacity and performance. *This means vital savings in construction costs!*

Make	Relative Space Requirements In Sq. Ft.	In Cu. Ft.
Multiclone	1.0	1.0
Collector A	2.1	1.8
Collector B	5.9	3.2
Collector C	6.8	3.9

COMPARE Dollar-Saving Adaptability!

Savings in space is just one of many ways MULTICLONE reduces installation costs. Because the shape of the unit can be readily varied (long and narrow, short and wide, or square) to fit available spaces, the MULTICLONE can often be tucked into odd corners and waste areas too restricted for other equipment.

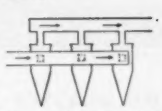
Moreover, inlet-outlet ducts can be varied—side-inlet side-outlet, or side-inlet top-outlet—to meet low headroom or restricted side clearance requirements . . . and the single-inlet single-outlet duct design permits greater flexibility and simpler installation. *These all add up to vital savings in installation costs!*



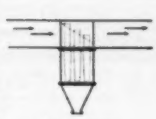
Side inlet, Side outlet **Side inlet, Top outlet**

COMPARE All-Around Simplicity!

The MULTICLONE is simple and inexpensive to maintain because there are no highspeed moving parts to repair or replace . . . no pads or filters to clean or renew . . . nothing to choke the gas flow or increase draft losses as suspended materials are recovered. In addition, the square, flat-sided shape of the MULTICLONE and its straight inlet and outlet ducts are far simpler to install and insulate. And since the recovered material from an entire bank of tubes is collected in a *single* hopper, it is much easier to service and maintain than the multiple hoppers of conventional cyclone units. *Here again, the* MULTICLONE *saves in many ways—all of them important!*



Conventional Cyclone



Multiclone

Whether your recovery installation is in a new structure or for modernizing present equipment, you will be far ahead by installing MULTICLONE Collectors. Our experienced engineers will gladly make helpful suggestions for simplifying your recovery problems. A letter, wire or call to our nearest office places this assistance at your service without obligation.

Send for Helpful Literature! This factual MULTICLONE literature explains the basic principles of cyclonic dust recovery and gives technical data helpful to anyone contemplating a dust or fly ash recovery installation. Write today for your free copy!

WESTERN Precipitation CORPORATION

ENGINEERS, DESIGNERS & MANUFACTURERS OF EQUIPMENT FOR COLLECTION OF SUSPENDED MATERIALS FROM GASES & LIQUIDS

Main Offices: 1049 WEST NINTH STREET, LOS ANGELES 15, CALIFORNIA

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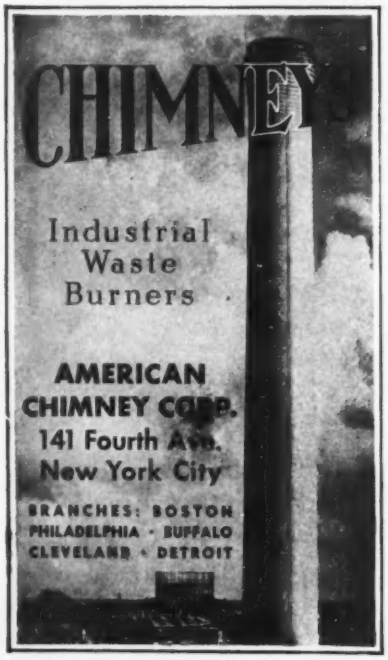
Featuring additional products, specialties & services for power plants



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High Pressure Rubber Gaskets
ALL SIZES TO FIT YOUR WATER GAGES

ERNST WATER COLUMN & GAGE CO.
Send for Catalog LIVINGSTON, N. J.

STOP *that* WATER

With FORMULA NO. 640, a clear liquid which penetrates 1" plus in concrete, brick, stucco, plaster, etc. Seals out water, dirt. Holds 20' head. Use outside and in. Preserves all absorbent materials. Sold 14 years. Quick, economical, sure. $3 in 55's. Free sample. See Sweet's.
HAYNES PRODUCTS CO., OMAHA 3, NEBR.

This
WHERE TO BUY
Section

supplements other advertising in this issue with these additional announcements of products and services essential to modern plant management and Maintenance. Make a habit of checking this page, each issue.
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POWER

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Space Heating and Industrial Processing
District and Municipal Heating
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BURNS & McDONNELL
Consulting and Designing Engineers
Kansas City, Mo. — P. O. Box 7088
Cleveland, Ohio — 1404 E. 9th St.

CARNAHAN & THOMPSON
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Mechanical and Electrical Consultants
320 Oklahoma Natural Building — Oklahoma City 2 Oklahoma

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Engineers and Consultants
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Steam — Diesel — Hydro — Sewage
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INTERNATIONAL ENGINEERING COMPANY, INC.
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TRANSMISSION — DISTRIBUTION
DESIGN—REPORTS—APPRAISALS—RATES
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LUTZ AND MAY
Consulting Engineers
STEAM, GAS & DIESEL POWER STATIONS
PUMPING PLANTS -ELECTRIC SYSTEMS
REPORTS—DESIGN- APPRAISALS
1009 Baltimore — Kansas City 6, Mo.

PETER F. LOFTUS CORPORATION
Engineering and Architectural Consultants
Power Plant and Industrial Design.
Reports, and Consultation
Pittsburgh 22, Pennsylvania
Established 1923

MORAN ENGINEERS
Designers and Consultants
Buildings — Power Plants
Air Conditioning — Ventilation
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FRED LEROY PEARSON, NSPE
Consulting Engineer
Mechanical — Electrical
1237 Majestic Bldg. — Telephone
Detroit 26, Michigan — Woodward 5-0188

PIONEER SERVICE & ENGINEERING CO.
Consulting and Design Engineers
Purchasing Specialists in
Financing, Accounting & Other Operations
231 So. La Salle St. — Chicago 4

SANDERSON & PORTER
Engineers and Constructors
New York • Chicago • San Francisco

SARGENT & LUNDY
Engineers
140 South Dearborn St. — Chicago, Illinois

J. E. SIRRINE COMPANY
Engineers
Power Plants — Consultations
Design — Reports
Water — Steam Utilization — Plans
Greenville — South Carolina

STANLEY ENGINEERING COMPANY
CONSULTING ENGINEERS
Power Plants
Steam — Diesel — Hydro
Design — Construction — Test — Valuation
Hershey Building — Muscatine, Ia.

JOHN A. STEVENS, INC.
Established 1909
Consulting Engineers
Power Plants — Paper Mills
Dye Houses — Surveys
Lowell, Massachusetts

SYSKA & HENNESSY, INC.
Engineers
Consultation — Plans — Reports
Power Plants — Disposal Plants
Water Systems
114 East 39th Street
New York, New York

WATER SERVICE LABORATORIES, INC.
Specializing Since 1927
Water Treatment for corrosion control in buildings, boilers and air conditioning systems.
New York—Philadelphia—Washington, D. C.

THE J. G. WHITE ENGINEERING CORPORATION
Design-Construction-Reports-Appraisals
89 Broad Street, New York 4

MECHANICAL ENGINEER

Large engineering and construction firm has permanent staff position open for mechanical engineer with experience in steam electric station operation to engage in plant betterment work which involves assistance in starting new units, testing, advising and consulting in respect to operating problems, improving steam plant efficiencies, advising in respect to procedures and maintenance practices, related problems. Reasonable knowledge of water treatment problems, practices, etc. desirable. Substantial traveling involved. Salary commensurate with experience; attractive company benefits. Give full particulars, age, education, experience in detail, and salary expected.

P-6286, POWER
330 W. 42nd St., New York 36, N. Y.

FUEL SPECIALIST

Established firm of consulting engineers has opening on its consulting staff for experienced technically qualified Fuel Specialist conversant with solid, liquid and gaseous fuels used in large steam electric generating plants; sources, characteristics, etc. Competent to make studies of comparative economics; determine market possibilities; determine trends as to costs. Also assist selection plant sites as sources and economic worth of fuels relate to selection. Utility background desirable. Give full particulars, education, experience and personal information.

P-6282, POWER
330 W. 42nd St., New York 36, N. Y.

WANTED
SENIOR ELECTRICAL ENGINEER

Southwestern Utility has opening. Applicants must have B.S.E.E. and several years practical electrical utility engineering experience. Please supply job brief, age, state of health, availability, salary expected. Recent photograph optional.

P-6636, POWER
68 Post St., San Francisco 4, Calif.

REPLIES (Box No.):
Address to office nearest you
NEW YORK: 330 W. 42 St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

ASSISTANT CHIEF Engineer. Wisconsin paper manufacturer has an opening for an individual to assist our Chief Engineer in charge of paper mill power plant, supervising the operation and maintenance of high pressure boilers, turbines and auxiliary equipment. As this is a key position in our engineering staff, and because our engineers are expected to operate on a reasonably independent level it is essential that the man we are looking for have a sound and complete knowledge of the technical and practical aspects of power in order to be considered for this position. The salary is open. In addition we have what we believe to be an excellent profit-sharing retirement plan and, of course, the company pays for the complete cost of group hospital and surgical insurance as well as life insurance. Your reply will be held in strictest confidence. Write P-6361, Power.

ELECTRICAL ENGINEER: Wisconsin paper manufacturer has an opening for an electrical engineer with some experience in maintenance and layout. The man we are looking for will have a sound grasp of the technical aspects of electrical engineering as well as a year or more experience in an industrial situation. He should be familiar with plant electrical requirements, power and control equipment and wiring, both A.C. and D.C. Salary based on individual ability with excellent opportunity for financial advancement. In addition, we have a profit-sharing retirement program and the company assumes the cost of complete group insurance coverage. Your replies will be held in confidence. Write P-6362, Power.

EMPLOYMENT SERVICE

SALARIED PERSONNEL. $3,000-$25,000. This confidential service established 1927 is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. G, 241 Orange St., New Haven, Conn.

(Continued on page 286)

FIELD ELECTRICAL ENGINEER

Whose duties would be to supervise the work done by the District Electrical Foreman in the various camps. This applies to the Plant with its auxiliary services and covers power distribution and utilization, but in general not power generation or transmission, large copper company Chile, South America. 3-year contract.

Transportation both ways and salary while traveling paid by Company.

In reply give complete details.

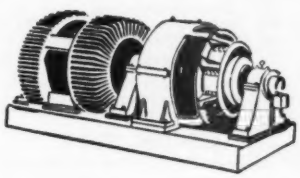
P-6065, POWER
330 W. 42nd St., New York 36, N. Y.

POWER PLANT ENGINEER

Large consulting engineering firm has staff position open for experienced engineer with utility background to engage in system planning studies, economic comparison of plans of development, comparison of sites, selection of steam pressures and temperatures, determination of energy production costs and related problems. This is a permanent position with salary commensurate with experience. Liberal company benefits. Give full details including personal data, education and experience.

P-6284, POWER
330 W. 42nd St., New York 36, N. Y.

SEARCHLIGHT EQUIPMENT SPOTTING SERVICE



This service is aimed at helping you, the reader of POWER, locate used and surplus new power equipment not currently advertised.

Just send in the specifications of the equipment wanted on the coupon below, or on your own company letterhead, to

Searchlight Equipment Spotting Service
c/o POWER
330 W. 42nd St., N.Y. 36, N.Y.

Your requirements will be brought promptly to the attention of the used equipment dealers advertising in this issue. You will receive replies directly from them.

NO CHARGE • NO OBLIGATION

Searchlight Equipment Spotting Service
c/o POWER
330 W. 42nd St., New York 36, N. Y.

Please help us locate the following used equipment:

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NAME ..... TITLE .....

COMPANY .....

STREET .....

CITY ..... ZONE ..... STATE .....

Additional Employment Advertising on Page 286

UTILITIES ENGINEER
FOREIGN SERVICE

To assist in the supervision of daily operations, the planning of new steam turbo installations, and the revision of existing units, as well as the lay out of power lines and sub stations. Must have E.E. degree plus minimum 5 years steam power plant experience, handling operational and maintenance phases.

Immediate and future job opportunities are also available for Electrical Engineers qualified in design or project work. Excellent promotional opportunities exist in all categories.

Write giving full particulars regarding personal history and work experience. Please include telephone number. Do not include original or valuable documents.

Recruiting Supervisor Box PO-1
ARABIAN-AMERICAN OIL CO.
505 Park Ave., New York 22

GET 2nd ENGINEER PAPERS IN 1 YEAR

(Yes, get better stationary engineers License!)

No correspondence school bother. Nationally-known Chief Stationary Engineer Frederick C. Walker's 100-Question, 100-Answer Bulletins give you the straight dope quick. Send $3 to Walker & Collins, 526 Ashland Ave., Buffalo 22, N. Y. for first set today. Keep working. Save year.

SLIP RING MOTORS: 2-100 HP AL. Ch. 3/60/440/580, Type ARYH, B.B.
50 HP G.E. 3/60/220/900 MT 546;
40 HP G.E. 3/60/220/1200 MT336;
30 HP G.E. 3/60/440/900 MT332;
20 HP G.E. 3/60/440/1200 MT322;
15 HP G.E. 3/60/220/1200 1 K;
5 HP Clevld. 3/60/220/1200 NV.
ALTERNATORS: 3 KVA, 1/60/1800 Chan. 120V.

ILLINOIS ELECTRIC WORKS, INC.
1306 Missouri Avenue, East St. Louis, Ill.

FOR SALE

2—Pumps, Buffalo 720 GPM at 1700 ft.—417 HP Turbine 575# steam, 10# BP
1—Water distillation unit Foster-Wheeler double effect 20,000 Gal/24 Hr.
1—Turbo-Generator unit, 60 KW—120 VDC, West. 200# steam, Cond.
2—Oil Circuit Breakers, 72000V, 400 amp, 100 MVA IC, Outdoor type GI

TRANSFORMERS

15— 50 KVA—12,000V-120/240
4— 75 KVA—12,000V-120/240
2—150 KVA—7200/12470Y-120/240

LEWON BROS.
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Ph. Atwater 2-2726

FOR SALE

150 K.W., 220 A.C.—125 V.D.C., 1200 R.P.M., G.E.—M.G. Set, A.C. and D.C. Panels.
4000 Ampere D.C. Switchboard.
2—2000 Ampere Generator and 4 Feeder Panels. Condition excellent.

OHIO VALLEY GENERAL HOSPITAL
Wheeling, West Virginia

USED AIR COMPRESSORS

Ingersol Rand—Water Cooled 5 x 4-7½ HP Motor $250.00. A-1 Shape. 6 x 5 15 HP Motor $250.00.

CONWAY HOTEL
Appleton, Wis.

POSITIONS WANTED

DIESEL POWER Plant operator and Maintenance mechanic. Ten years experience marine and stationary operation and repair, including five years dual fuel. Will consider taking charge of small plant. 1st assistant unlimited horsepower marine license. 2nd class Minnesota steam 100 H.P. Age 44 years. PW-5209, Power.

EXPERIENCED AND reliable mechanical maintenance engineer. Responsibilities and advancement opportunities desired. Power utilities preferred. Steam licensed. PW-6563, Power.

POWER ENGINEER with over 20 years experience plans making change. Exceptionally well qualified for superintendency of central station or power superintendent for industrial plant. Well-grounded technically in all phases of power plant operation. PW-6543, Power.

WANTED: POSITION as chief eng'r. or power plant supervisor. 22 years experience in steam electric plants, in operations, maintenance and testing of machinery. Have knowledge of engineering also marine eng'rs. license and best of references. Now employed desire change. PW-6643, Power.

COMPLETE TURBO UNITS WITH AUX. & BOILERS

(Subject to Prior Sale)

3750 KVA West. Cond. 350 lbs. 2400/4150 V.
2500 KVA G. E. Cond. 145 lbs. 2400/4150 V.
1875 KVA G. E. Cond. 240 lbs. 2400 V.
2500 KVA West. Cond. 150 lbs. 2400 V.
1000 KVA A. C. Cond. 135 lbs. 2300 V.
2 Engine Driven Generators 150 lbs. 2200 V., 200 KVA and 125 KVA Without Boilers

PUBLIC SERVICE COMPANY OF NEW MEXICO
P. O. Box 1360 Albuquerque, N. M.

WANTED

CASH FOR SURPLUS

MOTORS
GENERATORS
TRANSFORMERS
COMPRESSORS

WORLD'S LARGEST INVENTORY

See our other ads on pages 288 and 300

ELECTRIC EQUIPMENT CO.
ROCHESTER, N. Y.

EQUIPMENT FOR SALE

2—Pa. Air Compressors A1 Cond. (1949 Mfg.) 10"x7" stroke 252 CFM. 40# Press. 25 HP. 440 V. 3 P. 60 Cy. V Belt drives, Starters $600.00 each.
2—Ames Amm. Condensors, Valves. 30" x 16 ft. —109—2" tubes 250# ASME 350° F new 1949. $500.00 each.
Two Frick Vertiflow Brine Cooler Coils 1200 sq. ft. each. $450.00 each.
Four Vertical brine agitators with 3 HP motors 440 V—3 P—60 Cy. V Belt drives $100.00 each.

All F.O.B. South Bend. Ind.

POWER ENGINEER
915½ W. La Salle Avenue
South Bend, Ind.

BUYERS OF SURPLUS COPPER INSULATED WIRES AND CABLES

No lengths too long or too short
TELEPHONE: EASTGATE 7-4778

PIERCE CABLE CO.
2668 CLYBOURN AVE., CHICAGO 14, ILLINOIS

ARE YOU PLANNING A CHANGE IN YOUR WEST COAST SALES PICTURE?
Do You Plan To Expand With The West?

Our client, a live-wire West Coast Distributor with facilities for Warehousing, Sales and Distribution is interested in adding STEAM SPECIALTIES to other companion lines.

All Inquiries Confidential
Please reply to:

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681 MARKET STREET
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FILTERS

Two Refinite DF-2 units with Aloxite Carborundum elements. Capacity each unit, 80 gpm., with diatomaceous filter powder. Used only short time. Sell for half new price.

RIPLEY'S INC., Topeka, Kansas

FOR SALE

2—150 HP, H.T. Boilers, 72"x18'. One boiler in use only three years. Equipped with Stokers.

HOCKING VALLEY BRICK CO.
Nelsonville, Ohio

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Anything you want . . .
that other readers of this paper can supply
or—
Something you don't want
that other readers can use, advertise it in the
SEARCHLIGHT SECTION

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THE TRADE MARK WITH A MEANING SUCCESSFUL OPERATION GUARANTEED 44th YEAR OF SERVICE—MEMBER OF A.R.A.*

MOTOR GENERATOR SET

3 ph. 60 Cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
1	2000	G. E.	514	600	13800/4000
2	2000*	G. E.	500	600	6600/11000
3	1500	G. E.	514	250	4000/13200
1	1500	G. E.	720	600	6600/13200
1	1500	G E.	360	275	2300/4400
3	1500	G. E.	600	600	2300/4150
1	1500	C.W	514	115	2300
1	1200	A.C.	720	550	2300
2	1000	Whse.	900	600	2300/4100
1	1000	G. E.	900	260	6600
1	1000(3U)	G.E.	900	250	2400/4800
2	750	Whse.	900	275	2300/4160
1	750	C.W.	514	115	2300
1	600	G. E.	720	250	440/2300
1	500	Whse.	900	125/250	440
1	500	Whse.	900	250	6600/13200
1	500	Whse.	1200	125/250	2300
1	500	G. E.	720	125	2300/4000
1	400	G. E.	720	250	440/2300
1	400	Whse.	1200	250	2300
1	350	G. E.	900	125	2300/4150
1	150	G. E.	1200	250	2300
1	150	Whse.	1200	275	2300
1	150	G. E.	1175	125	440
1	140(3U)	Cr.-Wh.-	690	125/250	2300
1	125	G. E.	1200	125	440
1	100	Delco	1200	125/250	440
1	75	G. E.	1200	125	4000
1	50	Whse.	1775	575	208

*25 Cycle

ROTARY CONVERTERS

1—2000	G. E.	514	600	13800
1—1000	Whse.	900	600	11000

TURBO GENERATORS

Qu	KW	Make	Desc.
1	1000	Moore	Auto-Ext. Cond. 175/200# I.S.P. 5/20# G. Ext. Surface Condenser—3/60/2300.
	1000	G. E.	Non-condensing 175/200 lbs. I.S.P. 5/20 lbs. G.B.P., 480/3/60.
	750	G. E.	Condensing 425#-725*TT I.S.P. 440 V. 3 ph. 60 cy New — 1944
	750	Whse.	Non-condensing 135# I.S.P. 40# B.P. 750 Kw. 280 V. D.C.
	500	Moore	Non-condensing — 150/200 lbs. ISP 5/35 lbs. G.B.P.—3/60/480 volts direct connected exciter.
	500	G. E.	Non-condensing 175/200 lbs. I.S.P., 5/30 G.B.P., 480/3/60.
	400	Whse.	Non-condensing 125/150# I.S.P. 5/10# G.B.P., 240/480v. 3 ph. 60 cy.
	300	G. E.	Non-condensing 10/175# I.S.P. 5/15# B.P. 480V. 3 ph. 60 cy.
	200	Whse.	Non-condensing 150# I.S.P. 7# B.P. 240 V. 3 ph. 60 cy.

3—1500 KW—250 V. D.C.—13200 V. A.C.
NOW AVAILABLE.

D.C. MOTORS

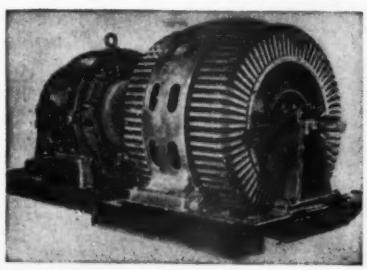
Qu.	H.P.	Make	Type	Volts	Speed
1—	2200	G. E.	MCF	600	360/500
1—	910	Whse.	QM R Brg.	250	140/170
1—	900	Whse.		250	450/550
1—	600	Al. Ch.	MILL	230	400/800
1—	500	Whse.	Mill	600	300/900
2—	450	Whse.		550	415
1—	400	G. E.	MCF	550	300/1050
1—	300/400	G. E.	DYNA	250	1325/2500
1—	350	Cr. Wh.	CCM-151H	230	1100
1—	335	Whse.	MQ	250	300/900
1—	200/300	G. E.	MPC	230	360/920
1—	250	G. E.	MPC	230	400/500
1—	200	Rel.	1970T	230	720
1—	150	G. E.		600	250/750
10—	150	Cr. Wh.	83H	230	890
1—	150	Cr. Wh.	CMC-65H	230	1150
1—	150	Whse.	SK-201	230	360/950
1—	150	Whse.	SK-151 B	230	900/1800
1—	50/120	G.E.	MFC	230	250/1000
2—	100	Whse.	SK-181	230	450/1000
1—	60	El. Dy.	23-S	230	525/1050
2—	50/60	Whse.	SK-170	230	400/1200
1—	50	G. E.	CO-1810	230	725
1—	50	Whse.	SK-170	230	350/1050

FREQUENCY CHANGERS

Qu.	KW	Make	Cycles	Voltage
1—	3000	G. E.	25/60	4000/2300x2300/4000
1—	2000	G. E.	25/62½	2300/4160
1—	2000	Whse.	25/62½	2300/2300
1—	1000	G. E.	25/58	4400/2300
1—	500	A. C.	25/60	11000/2300V

SYNCHRONOUS CONDENSERS

Qu.	Kva	Make	Volts	Speed
1	5000	Whse.	2400/4800	600

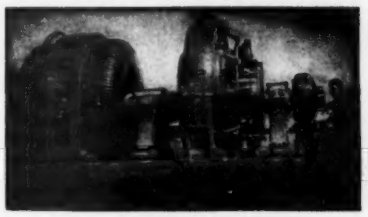


500 KW MG SET
IN STOCK

TRANSFORMERS

60 Cycles

Qu.	KVA	Make	Type	Ph	Voltages
3	2000	G. E.	HVDDJ	1	66000x13800
3	1000	G. E.	H	1	2200x480
3	1250	G. E.	H	1	6600x550
1	1150	A. C.	OISC	3	13200x2300/480
1	500	Whse.	OISC	3	13400x216
4	300	G. E.	HT	3	2400x240/480
3	150	Whse.	OISC	1	33000x2300/4000
3	100	G. E.	OISC	1	2400x120/240
2	75	Upte	OISC	3	4160x240
1	50	Mol.	Askerel	3	13200x120/208
3	10	G. E.	H	1	2300x115/230
9	7½	G. E.	H	1	2300x115/230



2000 KW—MG SET
IN STOCK

A. C. MOTORS

3 ph. 60 Cycle

SYNCHRONOUS

Qu.	HP	Make	Type	Volts	Speed
1—	5000	Whse.		2500/5000	600
1—	4350	Cr. Wh.		4160/13800	514
2—	3500	G. E.	TS	2300	257
1—	2500	G. E	ATI	2300	720
2—	2100	G. E.	ATI	2300	360
2—	2000	Whse.		2300	120
2—	1750	G. E.	ATI	2300	3600
3—	735	G. E.	ATI	2200/12000	600
1—	500	Ideal	SM	2300/4150	1800
1—	450	Whse.	Eng.	2200	128.5
1—	450	Whse.		2300	450
2—	350	G. E.	TS	2200	150
1—	300	Whse.		2300	720
1—	150	Whse.		440	600
1—	100	Whse.		550	600
1—	100	F.M.		220	1200

SLIP RING

1—1800	G. E.	MT-498	2300	360
1—1500	ABB		2300	720
1—1200	G. E.	MF-26	2300	275
1— 500	Whse.	CW	500	360
2— 500	G. E. unused	M-574Y	2200	900
1— 500	G. E.	IM	440	900
1— 450	Whse.	CW	4000	700
1— 400	Whse.	CW	440	514
1— 350	G. E.	MT-442Y	2300/4000	253
2— 300	G. E	MT-565Y	2300	900
1— 300	A. C.		410	514
1— 250	G. E.	MT-424Y	4000	250
1— 250	G. E.	MT-559S	2200	1750
1— 250	A. C.		550	600
1— 200	Cr. Wh.	26QB	440	505
1— 200	G. E.	IM	410	435
1— 200	G. E.	MTP	410	1170
1— 200	Whse.	CW	410	490
1— 200	G. E.	IM	440	600
1— 150 new	Whse.	CW	2300	450
2— 125	A.C.		440	865
1— 125	A. C.		440	720
4— 125	G. E.	MT-566Y	440/2200	435
1— 100	G. E.	IM-16	2200	435
1— 100	G. E.	IM	440	600
3— 100	Al. Ch.	ANY	440	695
1— 100	G. E.	MT556	2200	900

SQUIRREL CAGE

2— 650	G. E.	FT559BY	440	3750
2— 450	Whse.	CS	2300/4150	354
1— 200	G. E.	IK-17	400	580
3— 200	G. E.	KT557	410	1800
1— 200	G. E.	KT-559Y	2300	1200
1— 200	G. E.	IK	440	885
1—75/150	G. E.	IK	440	450/900
1— 150	Whse.	CS	440	580
1— 150	Wstghse.	CS8568	410	830
1— 125	Whse.	MS	440	480
1— 125	G E.	KF-TEFC	440	3585
2— 125	A.. Ch.	ARW	2200	1750
1— 100	G. E.	IK-Vert.	2300	150
1— 100	G. E.	KT-543	220/440	1750
2— 100	G. E.	IK	440	58

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PORTION OF ENGINE REMANUFACTURING FLOOR AND ONE OF THE ENGINE TEST STANDS AT OUR SAUSALITO, CALIF. PLANT.

A PARTIAL LIST OF OUR INVENTORY

KW	MAKE	MODEL	HP	RPM
1980	Nordberg	TS-217	3000	225
1500	Fairbanks Morse	33E16	2000	300
1136	Fairbanks Morse	38D	1600	720
1100	General Motors	16-278A	1600	720
1000	General Motors	16-567B	1440	720
750	General Motors	12-567	1080	720
500	General Motors	8-278A	750	720
500	Baldwin	VO-8	750	514
500	General Motors	8-567	720	720
400	Ingersoll-Rand	S-8	600	720
350	Baldwin	VO-6	510	450
320	Buckeye	80	480	600
320	Enterprise	DSG-6	460	450
250	Fairbanks Morse	33-D	375	360
300	General Motors	8-268A	450	1200
200	General Motors	8-268A	350	900
167	Ingersoll-Rand	S	255	600
160	Buckeye	80	240	600
150	Worthington	CC-4	225	450
100	General Motors	3-268A	150	1200
100	Worthington	BB-5	150	600
60	General Motors	6-71	90	1200

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ONE YEAR GUARANTEE!

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WORLD'S LARGEST INVENTORY

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Item B	3—1500 KW, 125/250 volt 500 RP MGE MG sets, 2100 HP, 11,000 volt, 25 cycle drive.
Item C	1000 KW, Allis Chalmers 250 volt, rotary convertor, any voltage
Item D	2—1000 KW, 250 volt MG sets, 25/60 cycle drive.
Item E	2—1000 KW, 600 volt, MG sets, 60 cyc. synchronous drive

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Fire Box Boilers—165 H.P.
Package Type Boilers—18, 30, and 100 H.P.
2 New Frederick Stokers—2500 lbs. of coal/hr.

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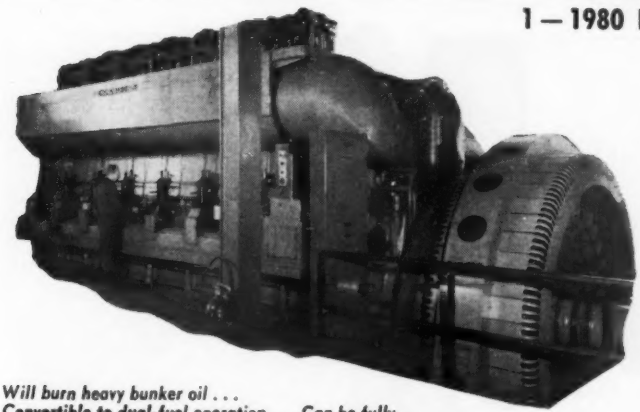
CURRENT MODEL·· DIESELS

3480 KW DIESEL GENERATOR PLANT

Heavy Duty • Slow Speed • Available Immediately

1 — 1980 KW NORDBERG MODEL TS-217 DIESEL UNIT



Will burn heavy bunker oil . . .
Convertible to dual-fuel operation . . . Can be fully inspected and test run . . . ONE YEAR GUARANTEE

ENGINE: 3000 HP (2800 BHP net) Nordberg, 7 cylinder, 2 cycle Diesel engine at 225 RPM, 21½" bore, 29" stroke, cylinders arranged vertical in line, solid injection.

GENERATOR: 1980 KW, 2475 KVA General Electric generator, 2400/4160/6900 volts, 3 phase, 60 cycle service at 225 RPM.

(50 cycle rating 1650 KW at 187 RPM)

UNIT AUXILIARIES AND ACCESSORIES

Complete standard engine auxiliaries and accessories including filters, strainers, pumps, gauge board, pyrometer, thermocouples, exhaust muffler, lubricating oil cooler, Young evaporative type cooler for jacket water cooling, thermostatic control valve, fuel oil day tank with transfer pump and oil meter, 2 lubricating oil storage tanks, lubricating oil transfer pump, Diesel-driven air starting unit, air tanks, air intake filter, special engine tools, all station piping, including flanges, adapters, valves, and fittings, for air intake, exhaust, water, lubricating oil, fuel oil, and air.

Generator and exciter control switchgear.

1—1500 KW FAIRBANKS MORSE MODEL 33E16 DIESEL UNIT

ENGINE: 2000 BHP Fairbanks Morse 10 cylinder, 2 cycle engine at 300 RPM, 16" bore, 20" stroke, cylinders arranged vertical in line, solid injection.

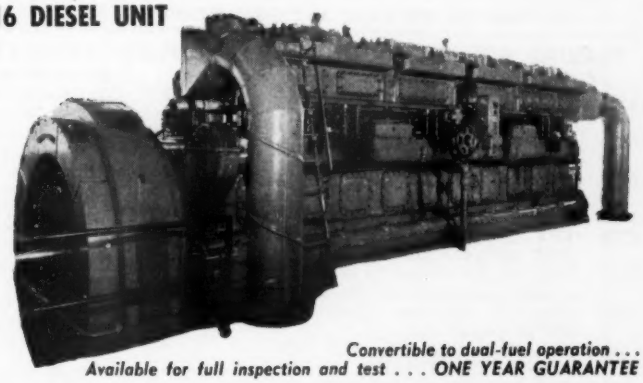
GENERATOR: 1500 KW, 1875 KVA Fairbanks Morse generator, 2400/4160/6900 volts, 3 phase, 60 cycle service at 300 RPM.

(50 cycle rating 1250 KW at 250 RPM)

UNIT AUXILIARIES AND ACCESSORIES

Complete standard engine auxiliaries and accessories including filters, strainers, pumps, gauge board, pyrometer, thermocouples, exhaust mufflers, lubricating oil cooler, Fairbanks Morse evaporative type cooler with automatic controls, fuel oil day tank with transfer pump and fuel oil meter, motor-driven air starting unit with air tanks, 2 lubricating oil storage tanks with transfer pump, air intake filter, special engine tools, all station piping, including flanges, adapters, valves, and fittings, for air intake, exhaust, water, lubricating oil, fuel oil, and air.

Generator and exciter control switchgear.



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The two units above afford a rare opportunity to procure complete, modern, current model, heavy-duty, slow speed diesel sets at a great saving. They represent an offering which cannot be duplicated anywhere in the diesel market today.

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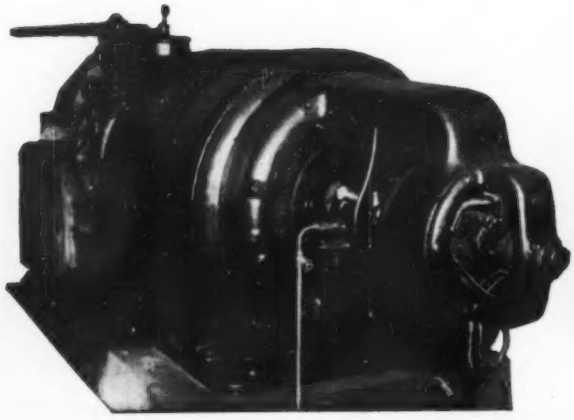
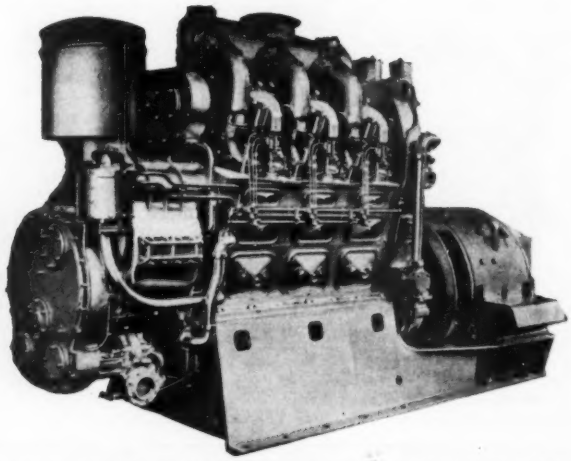


625 KVA G.E. 480 VOLT NON-CONDENSING UNIT



375 KVA GENERAL MOTORS 2300 VOLT DIESEL GENERATOR

TURBINE GENERATOR UNITS

Condensing—3 phase, 60 cycle

6250 KVA G.E., 5-stage, 2300/4160 volts, 200# PSI, 600°TT.
6250 KVA Westghse., 480 volts, 400 PSI, 15# G. extract with condenser.
5000 KVA Westghse., 600 volts, 275 PSI, 25# G. extract with conderser.
3750 KVA Westghse. 2300 volts, 200 PSI.
2500 KVA G.E., 2300/480 volts, 3600 RPM, generator **LESS TURBINE.**
1875 KVA G.E. 2300 volts, 180 PSI mixed pressure automatic extraction.
1000 KVA G.E. 450 volts, 275-400 PSI, 750°TT geared unit.
940 KVA Elliott, 2300 volts, 3600 RPM generator **LESS TURBINE.**
781 KVA Allis, 480 volts, 150 PSI.
625 KVA Elliott 2300 volts, 250 PSI.

Non-condensing—3 phase, 60 cycle

5000 KVA G.E., 13,800 volts, 600 PSI.
1563 KVA (1) G.E. 480 volts, 200 PSI. to 20# ga. back.
1250 KVA (2) G.E., 2300 volts, 150 PSI, 10# gauge back.
937 KVA ALLIS 480 VOLTS, 150#, 10# gauge back.
625 KVA G.E. 480 volts, 125-150 PSI, 20# back, photograph above. Reconditioned and guaranteed.
250 KVA G.E. 480 volts, 150#. PSI.
125 KVA Westghse., 2400/480 volt, 125-250#, 5# ga. back. Geared unit.

UNAFLOW GENERATOR UNITS

3 phase, 60 cycle

750 KVA E.M. 240/480/600 volts generator connected Skinner Vertical engine, 150 PSI, 8# gauge back.
575 KVA G.E., 2300 volts generator connected Nordberg engine 200# PSI.
500 KVA G.E. 240 volts generator connected Skinner Vertical engine, 150-175 PSI complete.
375 KVA Westghse., 2400/480 volts connected Ames Vertical engine.
375 KVA Westghse. 600 volts connected Skinner engine, 150 PSI, 10# back.
312 KVA G.E. 240 volts connected Skinner engine, 125 PSI, 5# back.

DIRECT CURRENT UNITS

540 KW Westghse. non-condensing turbine 250 volts D.C. NEW, 200# PSI.
400 KW G.E., 3-wire, 250 volts, 360 RPM generator connected Skinner vertical engine 150 PSI—5# back.
300 KW Westghse. 3-wire, 250 volts 150/250# PSI noncondensing turbine.
300 KW (2) Westghse, 3-wire, 240/125 volts condensing turbines. 440# PSI.
250 KW Crocker Wheeler 125 volts generator direct connected Ames vertical non-condensing engine 150#.
100 KW G.E. 120 volts condensing or non-condensing geared 200-275 PSI.
60 KW (6) Elliott 125 volts condensing or non-condensing 200-250 PSI.

DIESEL GENERATOR UNITS

3 phase, 60 cycle

1500 KVA (2) 2300 volts, 720 RPM Fairbanks Morse O.P. engine generators, modern.
1250 KVA (3) Elliott 2300/4160 volts, 720 RPM connected to G.M. Model 16-278A engines. NEW.
1000 KVA G.E. 2400 volts, generator connected to Enterprise engine.
937½ KVA G.E. 2400 volts generator connected General Motors engine.
875 KVA Westghse. 2400/4160 volts, 327 RPM generator connected De-Lavergne engine.
750 KVA G.E. 2400 volts, generator connected to Enterprise engine.
400 KVA (3) Elec. Mchy. 440 volts generators each connected to 6 cylinder Alco engine. Complete.
375 KVA Allis 2300/4000 volts generator connected General Motors engine complete installation. (Actual photograph above.)
375 KVA E.M. 480 volts, 600 RPM generator connected Buckeye engine complete.
250 KVA (2) Westghse. 220/440 volts generator connected to Buckeye engine.
175 KVA F.M. 2300 volts, 300 RPM connected Fairbanks 32-E-14 engine 1948.
20 KW Louis Allis, 125 volts generator connected 64 HP Hill engine.

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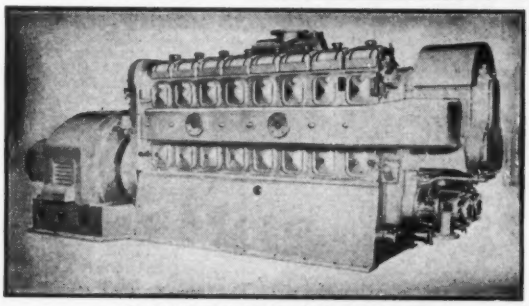
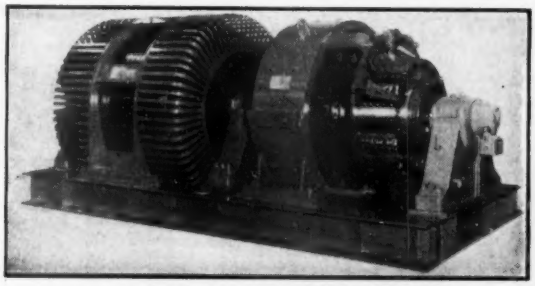


375 KVA GM DIESEL GENERATOR SET



500 KW WEST. MOTOR GENERATOR SET

MOTOR GENERATOR SETS

1—1000 KW West. 250 volt Flat Compound 500 RPM 1440 H.P. West. Syn. Mtr. .S P.F. 3/25 cycle 2300 V. A.C. & D.C. Panels
1—500 KW Westinghouse 250 Volt 900 RPM with 720 H.P. West. Syn. Motors 3/60/6600/13200 volt, Serial #813047 (year 1935) See actual photo above.
1—500 KW Crocker Wheeler CCD, 250 volt 720 RPM with 750 KVA Cr. Wh. Syn. Motor 3/60/2300 V. A.C. & D.C. Panels.
1—300 KW West. 3 wire 125/250 Volt 1200 RPM Generator (1938 year). Can furnish with suitable motor. Advise Requirement.
2—150 KW G.E. Type MPC—250 Volt 1200 RPM 3/60/2300/200 H.P. Syn. Motor Drive A.C. & D.C. Panels
1—100 KW Al. Ch., 250 V. 1200 RPM 150 H.P. Syn. Mtr. 2/60 or 3/60 any voltage.
1—100 KW G.E.—C.D.—125 Volt D.C. 150 HP GE Syn. Mtr., 3/60/220/440/1200 RPM.
1—75 KW Burke 250 V. 900 RPM 113 H.P. Burke—Syn. M.D. 2 or 3 ph, any voltage.
2—50 KW GE 500 Volt DC, 75 HP, 3/60/440/1200 RPM.
Smaller Sizes and Types—Advise Requirements

OISC TRANSFORMERS

Qu.	KVA	Make	Pri. V.	Sec. V.	Phase
3	4000	GE	33000	13200	1
3	1000	GE	13200	2300	1
1	1000	Penna.	13200	480	1
1	1100	West.	4440	440	3
3	833	GE	13800	460	1
3	750	West.	2300	230	1
3	500	GE	13200	2300	1
3	333	(New)	2400	480	1
3	333	GE	13200	2300	1
3	250	West.	13200	2300	1
3	200	GE	7200	120/240	1
3	200	GE	13200	2300	1
3	200	Mal.	2300	220/440	1
3	200	GE	13200	2300	1
3	200	GE	7200	2300	1
3	150	GE	33000	220/440	1
3	150	Niag.	2400	240/480	1
3	100	West.	11000	480	1
3	100	GE	7200	120/240	1
2	100	GE	2300	115/230	1
3	75	Mal.	2300	115/230	1
3	50	GE	13200	120/240	1
3	50	GE	13200	2300	1
4	37½	West.	2400	240/480	1
3	25	West.	2300	115/230	1
3	25	West.	6900	2300	1
2	15	GE	2400	120/240	1
3	10	GE	220	110	1
10	1½	GE	2400	120/240	1

OISC TRANSFORMERS (Con't)

DIESEL & GASOLINE GENERATOR SETS

6—875 KVA G.E.—Busch Sultzer 3/60/2300/275 RPM, Complete Plant, 1940
5—475 KVA Cooper Bessemer 400 RPM 3/60/2300, Complete Plant, New 1940
1—375 KVA GM 8-268A, 3/60/480/1200 RPM
1—187 KVA G.M. Twin 6-71 Portable, 3/60/220/440 New
1—125 KVA Hercules. 3/60/220/440/1500 Hrs.
1—56 KVA Climax Gasoline, 3/60/220/1200.
2—45 KVA Chry. New 6 Cyl. 3/60/220/440.

ELECTRIC MOTORS

Qu.	HP	Make	Type	Volts	Speed
1	1000	West.	CW	2300	450
1	600	West.	CS	2200	600
1	500	AC	ARX	2300	1800
1	500	West.	CS	6600/2300	514
1	450	A.C.	ANY	2300	600
2	400	G.E.	IK	2300	1800
1	400	West.	CW	440	514
1	400	G.E.	Syn.	2300	450
1	350	West.	TEFC	440	1800
1	350	G.E.	MT18	2300	400
1	315	G.E.	Syn.	2200	720
1	200	G.E.	IM	440	600
1	125	West.	Syn. 3 brg.	550	600
2	100	G.E.	Syn.	440	300
1	50	West.	CS	440	3600
1	50	West.	CS	440	1200

COMPRESSORS

968 CFM Sullivan 13x13x8, 50 psi.
868 CFM Sullivan 17x10x12, 100 psi.
528 CFM Ing. Rand 14x12, 100 psi.
368 CFM Chi. NSB, 12x10, 100 psi.
173 CFM Pa. 3A—9x8, 100 psi.
122 CFM Worth. 7x7, 100 psi.
89 CFM I.R.—ES 16x7, 150 psi.

TURBO GENERATORS

1—1250 KVA DeLaval Non-Cond. 3/60/2300. New 1940 240 psi 50 lb. B.P.
1—780 KVA G.E.-Moore 3/60/2300/3600 RPM Non-Cond. 180 PSI 35 lb. B.P. New 1936.
1—500 KVA West. Non-Cond. 3/60/220/440, 150 PSI 10 lb. B.P.
1—375 KVA West. Non-Cond. 3/60/440, 125 PSI 5 B.P. New 1938.
1—200 KVA Moore Non-Condensing 3/60/480, 195 PSI, 100° F, 100# BP. Year 1936.
1—187 KVA West. Non-Cond. New 1930 3/60/440 110 psi 10 lb. B.P.
1—94 KVA Worthington Non-Cond. 3/60/220 140 psi 5 lb. B.P.
1—75 KW G.E. Non-Cond. D.C. 125 volt.

MOTOR GENERATORS

1500 KW G.E. 250 Volt 3/60/2300/360 RPM
100 KW Electro Dynamic 200 V. 3/60/220/1200 B. Brg. Sq. Cg. Syn. Excited.
200 KW Elliott 250 Volt 1200 RPM 3/60/Any Voltage.

DIESEL GENERATORS

200 KW G.M. Twin 6-71, 240 D.C. Rad. Cooled Elec. Start.
1250 KVA Nordberg 3/60/2300/360 RPM new 1940.
250 KVA G.M. Twin 6-71, 3/60/220/440/1200 RPM Rad. Cooled.

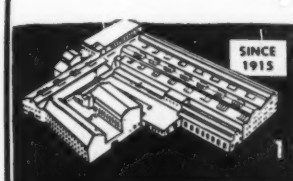
AIR COMPRESSORS

1—12,000 CFM I.R. Turbo 3.25 lb., direct 250 H.P., 440/3/60/3600.
1—5600 CFM I.R. PRE-2, 42/25½x30, 100 lb. direct 930 HP Syn. 1 P.F. 2300/60/3.
1—4690 CFM I.R. PRE-2 48/24x27 100 lb. direct 804 HP Syn. .8 PF 2300/60/3.
1—3000 CFM GE Turbo 5 lb. direct 90 HP 440/3/60/3600.
2—1400 CFM Sullivan WJ 8 Angle Cpd. 100 psi 22/13x16 belt.
1—900 CFM CP 100 lb. 9CP Portable Diesel Compressor, Pneu. tires.

BOILERS

1—60 H.P. Ames Package 125 psi, 1947.
2—200 H.P. Bigelow Scotch, 150 Lb. Oil Fired, 1940.
1—300 H.P. Keeler CP, 160 Lb. Stoker 1940.
1—350 H.P. Keeler CP, 160 Lb. Oil Fired.

"Everything from a Pulley to a Powerhouse"



SINCE 1915

THE O'BRIEN MACHINERY CO.

REG. U.S. PATENT OFFICE

PHILADELPHIA'S LEADING MACHINERY DEALERS & EXPORTERS

1547 N. DELAWARE AVE., PHILADELPHIA 25, PA.

• Telephone GArfield 6-1150 • Cable Address O BRIEN PHILA.

AFFILIATED WITH SOC EXPANSO INDUSTRIAL SOL AMERICANA LTDA RIO DE JANEIRO—BRASIL

GET MORE FOR YOUR MONEY FROM HEMPHILL GUARANTEED EQUIPMENT

GUARANTEED GOOD BECAUSE REBUILT AND TESTED BY HEMPHILL ELECTRICAL ENGINEERS

TRANSFORMERS—60 Cycle

Qu.	KVA	Make	Type	Ph	Voltages
1	1500	GE	Pyranol	3	4150x2400
2	750	GE	HT	3	4150Yx120/240
1	500	Kuhl	OISC	1	4600x2300
2	400	Pitts.		1	2400/4800x240/480
1	333	GE	OISC	1	13200x220/440
4	333	West.	OISC	1	2300/575
1	225	Stand	OISC	1	440x220
1	200	GE	HT	3	2300x220
1	200	Pitts.	ODSC	1	4000x110/220
1	200	Mot.	C	1	2300x220/440
2	200	Al. Ch	OISC	1	480x120/240
2	150	Pitts.	OISC	1	240x120/240
3	100	West		1	13,200/-220/440
3	100	Wagner	HEB	1	240x120/120
1	100	Amer.		1	15000x2300
3	100	GE	Auto	1	4150Y2400Y
3	50	GE	H	1	2400/4800x120/240
9	50	GE	H	1	13750x125x216Y
1	50	Al. Ch.	ODSC	1	13550x120/240
2	50	Pitts.	Sub	1	13530x120/240
1	50	Amer.	OISC	1	6600/13200x220/440
1	50	Amer.	WF	1	240x240/30
1	50	GE	KS	1	2300x230
1	37	GE	H	1	2200x110/220

SYNCHRONOUS MOTORS

Qu.	H.P.	Make	Speed	Type	Volts
1	300	El. Mach.	720	TEFC	2200
1	150	GE	720	ATI	2300
1	150	GE	1800	TS	220
1	150	Whse.	900		220

MOTOR GENERATOR SETS

Qu.	KW	Make	Speed	DC	AC
1	1000	Whse.	720	600	2300/4150 Syn.
1	1000	GE	514	600	2300/4150 Syn.
1	150	GE	1200	125/250	2300 Syn.
1	150	Whse.	600	125	4150 Syn.
1	125	CW	1200	125	220/440 SC
1	100	GE	900	250	2300 Syn.
1	94	GE	1200	60	4150 Syn.
1	30	GE	900	230	220 Syn.
2	30	GE	1200	125	440 SC.

SLIP RING MOTORS

Qu.	H.P.	Make	Speed	Type	Volts
1	400	Whse.	450	CW	550
1	250	Whse.	600	CW	440
1	200	Whse.	600	CW	440
1	200	GE	600	MT	440
3	150	AC	1800		2400
1	100	GE	600	IM	440
1	100	GE	400	IM	440
1	75	GE	500	IM	440

SPECIAL WELDING

1—150 KVA GE, type KWC, 1 ph., 550 V, sec. 12.22/6.05 V, Thryatron Spot and Seam, Control CR 7503

SLIP RING MOTORS—(Con't)

1	75	GE	1200	MT Vert.	220
1	60	GE	1750	MT	220
1	60	GE	900	MT	440
1	50	GE	1720	MT	220
1	50	Whse.	900	CW	220
1	50	GE	1700	MT	220
1	50	GE	600	MT	220
1	40	GE	1200	MT	220

REDUCTION GEAR

1—150.H.P. Terry Reduction, ratio 5.4:1 type XA 435 input 80 output RPM.

SPECIAL M.G., A.C. WELDER

1—176 KVA Whse., 220 V. 57 PF, 1200 RPM, 1 ph., with 75 HP Slip Ring, 440 V, type CW, Exc. & Control w. flywheel.

Member of the National Industrial Service Assn., Inc.

"FOR POWER"
J. L. HEMPHILL & CO.
1604 53rd STREET, NORTH BERGEN, N. J.
PHONE NEW YORK—LONGACRE 5-3227
PHONE NEW JERSEY—UNION 3-2600

Anything in ELECTRICAL EQUIPMENT

PARTIAL STOCK LIST — SEND US YOUR INQUIRIES

MOTOR GENERATOR SETS

150 KVA Westinghouse 275 V. D.C. 3/60/2300-1200 RPM

150 KVA Allis Chalmers 275 V. D.C. 3/60/2300-1200 RPM

ROTARY CONVERTERS

1000 KW. G.E. 600 V. D.C. 900 RPM. 6 PH. Interpole, Type NCC with transformers 13,800 V

4—500 KW WH 600 V. D.C. 1200 RPM. 6 PH. Interpole, Type HCC, with transformers 27,600 V. Automatic switchboards and automatic brush lifters.

SYNCHRONOUS MOTORS 3/60/2300

3—125 HP G.E. Type TS, Form PK, P.F.—1—900 RPM

1—175 HP G.E. Type ATI, Form PB, P.F.—1—450 RPM

1—400 HP W.H. Form IS, P.F. .8—P.B. 900 RPM

6—175 HP W.H. P.F.—1—3600 RPM, 440 V

T.E.F.C. — MOTORS

QTY.	HP	MFG.	FRAME	RPM	TYPE
1	40	Cent.	444	1750	SC
3	30	Armour	445	900	K
1	30	F.M.	405	1800	Q
1	20	Delco	405	900	
10	15	G.E.	326	1800	KGXP
15	5	W.H.	254	1750	CS
17	5	Cent.	284	1150	SCXP
5	3	G.E.	225	1750	KGXP
7	2	G.E.	225	1750	KGXP

MOTORS, GEAR HEAD A.C.

2 HP Link Belt, Size DM30, XP, 3/60/220/440-45 RPM—R.B.

5 HP Link Belt, Size DM30, 3/60/220/440-84 RPM—R.B.

7½ HP W.H. TEFC, 3/60/220/440-580 RPM—R.B.

20 HP Link Belt, Size DM70, 3/60/220/440-74 RPM—R.B.

20 HP W.H. TEFC, 3/60/220/440-194 RPM—R.B.

40 HP G.E. TEFC, 3/60/220/440-561 RPM—R.B.

GEAR REDUCERS

3—Falk, Type 11HCP, 200 HP, Ratio 10:1

BUCKEYE
Trading Corporation
LARGEST STOCK IN MIDWEST
1015 to 1021 PAPIN STREET — CHESTNUT 3110 — ST. LOUIS 2, MISSOURI

STEAM TURBINE GENERATOR UNITS
3 phase, 60 cycle

5,000 KVA General Electric noncondensing extraction, 600 lbs. steam pressure, 750° FTT, 125/150 lbs. extraction, 0-50 lbs. exhaust, 13,800/4000 volts.

2,500 KVA Westinghouse condensing, 200/400 lbs. steam pressure, 700° FTT, 2400 volts, with surface condenser.

1,563 KVA General Electric noncondensing, 250 lbs. steam pressure, 700° FTT, 15 lbs. exhaust, 2300 volts.

1,250 KVA Allis Chalmers condensing extraction, 250 lbs. steam pressure, 600° FTT, 25 lbs. extraction, 480 volts with surface condenser.

UNIFLOW GENERATOR UNIT
3 phase, 60 cycle

750 KVA Allis generator, 240/480/600/2300/4160 volts, 277 RPM direct connected to Ames vertical uniflow steam engine. Still installed—Excellent condition.

GENERATORS
3 Phase, 60/240 Cycle

2500 KVA G.E. 60 cycle, 2400/480 volts, 3600 RPM

2859 KVA (3) G.E. 240 cycle, 4160 volts, 4800 RPM

4600 KVA G.E. 90 cycle, 2400 volts, 5400 RPM.

Write, wire or phone:

INTERNATIONAL POWER MACHINERY COMPANY

Union Commerce Bldg., Cleveland 14, Ohio
Telephone: Main 1-9514

FEBRUARY 1953

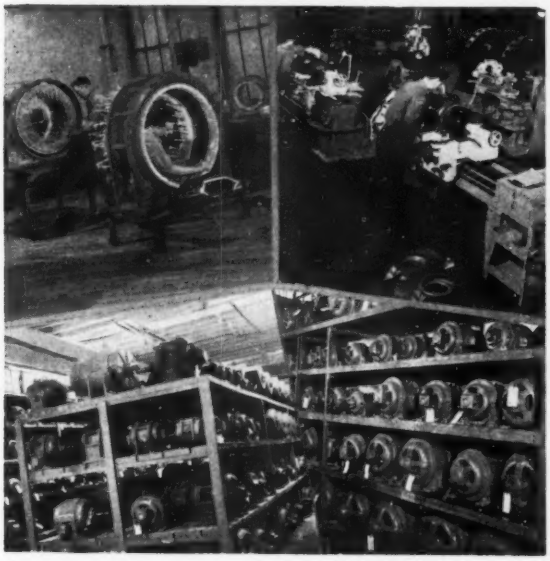
CHICAGO Electric Digest

PUBLISHED BY CHICAGO ELECTRIC CO. • THE HOME OF GUARANTEED REBUILT POWER EQUIPMENT

GUARANTEED "REBUILTS" GIVE A-1 PERFORMANCE

MODERN PLANT, LATE-TYPE MACHINES AND EXPERT WORKMEN ARE AN OUTSTANDING COMBINATION

CHICAGO ELECTRIC's plant is modern in every sense of the word . . . it is fully equipped with the latest type machines and testing equipment . . . it is staffed with competent and experienced workmen. This combination of machines and men has provided users of electrical power equipment with a guaranteed and outstanding service for over 42 years.



D. C. MOTORS

Mill Type—Pedestal Bearing Reversing

H.P.	Make	Volts	Speed
3000	Westgh. (Tandem)	525	600
1750	Westgh.	600	550
1500	Westgh.	525	600
1200	Westgh.	525	600
1000	Westgh.	450	600

Mill Type—Non Reversing

H.P.	Make	Type	Speed
1500	Westgh. (600 v)		200/400
700	Westgh. (600 v)	MCF	150/525

230 Volts—Constant Speed

H.P.	Make	Type	Speed
175	G.E.	ELC	750
125	G.E.	Marine	1200
100	G.E.	RC34	2500
100	G.E.	RC19	575
75	G.E.	MD8106	485
60	G.E.	CD-115	860
50	G.E.	RC35	700
50	G.E.	CO2004	600
40	Cr.-Wh.	CMC	1750
35	Cr.-Wh.	CM351	700
30	G.E.	MD104½	725
30	Cr.-Wh.	CCM 4	440
25	G.E.	CD93	1200
25	G.E.	RC32	800
25	Westgh.	SK100L	1100
25	Westgh.	SK133	575

MANY OTHERS — 1 HP AND UP ALSO VARIABLE-SPEED AND 115 VOLTS

IF YOU DON'T FIND WHAT YOU WANT LISTED WIRE, WRITE OR PHONE TODAY!

COMPLETE STOCKS ON HAND

CHICAGO ELECTRIC's modern plant also houses one of the nation's largest stocks of guaranteed rebuilt power equipment . . . AC & DC MOTORS, M. G. SETS, GENERATORS, CONVERTERS, COMPRESSORS, HOISTS, PUMPS, TRANSFORMERS, CONTROLS and other allied equipment . . . so, whatever you need and whenever you need it . . . be sure to check with CHICAGO ELECTRIC first!

TRANSFORMERS

KVA	Make	Ph.	Prl.	Secondary
1000	Westgh.	3	4800	480
850	Westgh.	3	4160	465
667	G.E.	1	33000	480
333	A.C.	1	14400	240/480
300	G.E.	3	13800	240/480
300	G.E.	3	2400	240/480
200	Wagner	1	2400	575
167	A.C.	1	2400	120/240
100	Pitts.	1	2400	575
100	A.C.	1	2400	120/240

PUMPS

GPM	Make	Type	Head
800	Worth	6D8	925 ft
500	Manistee	H	250 ft
300	Al.-Ch.	NMZ	800 ft.

SLIP RING

MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 Volts or Higher)

H.P.	Make	Type	Speed
2500	*G.E.	MT	257
1500	*G.E.	MT30	240
1000	*Westgh.	CW	250
700	*A.C.		720
500	*G.E.	IM	3600
500	*G.E.	MTP	1800
500	G.E.	IM	720
500	Westgh	CW	350
400	A.C.	3-Brg.	450
400	*G.E.	MT412	450
300	*G.E.	IM15A	1800
300	*G.E.	MT410	450
250	Westgh	HF15H	600
200	G.E.	IM	1800
200	Westgh.	CW	600
150	Westgh.	CW772C	1200
150	*G.E.	IM16	600
125	*G.E.	MT549	1800
125	G.E.	IM15A	600
100	A.C.	ANY	900
100	G.E.	IM15A	1800
75	Northwestern	HW50	1800
75	G.E.	MT356	900
75	G.E.	IM14	600
60	Westgh.	CW762C	900
50	G.E	IM11A	1800
50	*A.C.	ARY	1800
50	Westgh.	CW642C	1200
50	G.E.	MT346	720
50	G.E.	IM14	450
40	G.E.	MT336	1200
40	Westgh.	CW644	900
40	G.E.	M504U	900
35	Fairbanks-M	UAB (Vert	1800
35	G.E.	IM	1200
30	G.E.	MT532	900

M. G. SETS

K.W.	Make	A.C.	D.C.
2400	A.C. (3-unit)	4800	525
2400	West. (3-unit)	4800	600
1000	G.E. (3-unit)	11000	137½/275
1000	West. (3-unit)	11000	137½/275
500	A.C.-Westgh.	2300	250
500	Cr.-Wh.	220/440	250
450	G.E. (3-unit)	2300	125/250
400	A.C.	2300	120/240
250	Westgh.-G.E.	440	250
200	Ridgeway	2200	250
150	G.E	2300/440	250
150	G.E.	2300/4000	125/250
150	G.E.	440	275
100	G.E. (25 cy)	440	125
100	G.E.	2300	250
100	Delco-GE	440	120/240
90	G.E.	440	60
75	A.C.	440	250
60	A.C.	2300	110
60	G.E.	440	250
40	Cr.-Wh.	220	125
40	A.C.	220	125
40	G.E.	220	125
35	G.E.	440	125
25	Westgh.	2200	125
25	G.E.	220	275
20	G.E.	440	250
20	Bogue-G.E.	440/550	250
20	Bogue-G.E.	220/440	260
20	Bogue-G.E.	220/440	125

DC To AC

100	G.E.	230	235
75	Westgh.	2300	110
12½	Westgh.	240	115

ENG. GENERATOR SETS

KVA	Make	Type	Volts	Speed
300	Gen. Motors	6-268A	480	1200
100	Gen. Motors	6-71RC	480	1200
100	Gen. Motors	3-268A	480	1200
31	Cummins-Roger	H-I-6	120/208	1200
25	LeRoi	20-A	120	900

PHONE: CANAL 6-2900

CHICAGO Electric Co.

1320 West Cermak Road, Chicago 8, Ill.

SQUIRREL CAGE

MOTORS

3 Phase, 60 Cycle, 220 or 440 Volt (*2200 Volts or Higher)

H.P.	Make	Type	Speed
1750	*G.E.	K	3600
1000	*G.E.	K63478	1800
750	*A.C.	TEFC	1800
750	*G.E.	KT	720
700	G.E.	FT	3600
500	*G.E.	PBG	3600
500	*A.C.	63168W	1800
450	*G.E.	KF567S	1200
400	*Westgh.	CS	1800
400	*G.E.	KPT562	1800
400	A.C.	ANW	900
400	*G.E.	IK	514
350	*Cr.-Wh. BBDP	SC	3600
300	*Westgh.	CS	3600
250	*L. Allis	OG8	1800
250	*L. Allis	OGX1488	720
250	G.E.	IK	600
200	*G.E.	FT549Y	3600
200	A.C.	ARWWT	600
200	G.E.	IK-17	600
150	*A.C.	AN	1800
150	*G.E.	IK	600
150	A.C.	AR	325
125	Westgh.	CS5048	3600
125	*A.C.	AR226	1800
125	G.E.	IK	1200
100	*G.E.	FT542Z	1800
100	Westgh	CS	1800
100	G.E.	IK13A	1200
100	U.S.	CFU (Vert)	1200
100	A.C.	AN	900
100	G.E.	IK15A	514
75	Westgh.	CS4458	3600
75	A.C.	AN	1800
75	Westgh.	CS645C	1800
75	G.E	IK	1200
75	Westgh.	CS	900
75	A.C.	AN	720
75	G.E.	IK	600
75	*Triumph	TR16	514
60	*Westgh.	CS5048	1800
60	G.E.	KT343	1200
60	A.C.	AR823	900

Hundreds of Smaller Motors!

AC SYNCHRONOUS

MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 Volts or Higher)

H.P.	Make	Type	P.F.	Speed
2500	*A.C.		1.0	514
1420	*Westgh.		.7	900
720	*G.E. (25 cy)	ATI	1.0	750
700	*G.E.	TS975Z	1.0	1200
600	*G.E.	TS7640	1.0	900
400	Westgh.	22E38	1.0	900
300	G.E	ATI	.8	900
300	Ideal	SNS	1.0	257
190	El.-Machy.	28	1.0	720
150	*Westgh.	HR	1.0	300
125	*El. Machy.	XXX	1.0	900
125	*G.E.	TS	1.0	277
115	El. Machy.	EM	1.0	240
100	Cr.-Wh.	1038	.8	900
100	Westgh.		1.0	900
100	G.E.	TS6154	1.0	450
40	G.E.	ATB	.8	1200
20	Fynn-W.	15VRN		1200
15	Ideal			1800
15	Century	ARC365	1.0	1200
7½	Ideal			1800

AC SYNCHRONOUS

GENERATORS

3 Phase, 60 Cycle, 220 or 440 Volt (*2200 Volts or Higher)

KVA	Make	Type	P.F.	Speed
3500	*G.E.		.8	720
1750	*Westgh.		.7	900
1500	G.E.	ATI	.8	720
312	G.E.	ATI	.8	900
300	*G.E.	ATI	.8	720
112½	*G.E.	ATB	.8	1200
110	Cr.-Wh.	103	.8	900
100	*G.E.	ATB	.8	900
60	Fairbanks-M	B	.8	900
55	G.E.	ATB	.8	1200
50	G.E.	ATB	.8	1200
50	Westgh.			1200

MOTORS • GENERATORS • TRANSFORMERS

7 x 7 AIR COMPRESSOR

Ingersoll Rand 7x7 Class ERI—100#—with or without drive.

1—400 KW Westinghouse 500 V. DC 750 RPM 800 Amps. Motor—580 H.P. Synchronous 3 Ph. 25 cycle 440 V. 750 RPM.

ANODIZING M.G. SET

33 KW Gen. Elect. Type BR. Form C 60 V. DC. Direct connected to 50 HP 3/60/440/1800 Gen. Elect. Motor.

400 HP GEAR REDUCER

1—400 HP Nuttall (Westinghouse) Type LMR-25 Single Helical Heavy Duty Reducer—6-1 Ratio at 900 RPM with High Speed Shaft Extension for Brake.

400 HP SYNCH. MOTOR

1—400 HP Westinghouse Synchronous Motor. 3/60/2300/900 RPM. Unity P.F. with direct connected exciter—Late Type.

55" LIFTING MAGNETS

2—55" Cutler Hammer Magnets 250 Volts DC. Excellent Condition.

350 KW GENERATORS

2—350 KW General Electric Generators Type MPC, 250 Volt DC, 720 RPM Single Bearing Machines.

MOTORS

60-50-25 Cycle in Stock—All Sizes. Slipring—Squirrel Cage—Synchronous. All types of Control Equipment.

100 HP Westinghouse Slipring 3 Bearing 3/60/220/440/435 RPM.

100 HP Gen. Electric Type I form K 3/60/2300/600 RPM.

100 HP Gen Electric Type KT 356 3/60/2200/900 RPM.

125 HP Gen. Electric Type I form K 3/60/440/720 RPM.

125 HP G. E. Type KT 3/60/2300/1200 RPM.

150 HP G. E. Type KT 3/60/440/500 RPM.

150 HP Gen. Electric Type I form K 3/60/2300/900 RPM.

200 HP Gen. Electric Slipring Type I form M 3/60/440/600 RPM.

200 HP G. E. Type KT 3/60/440/600 RPM.

250 HP G. E. Type KT 3/60/440/720 RPM.

T.E.F.C. MOTORS

60 HP Westinghouse CS-687 3/60/440/900 X-Proof

50 HP Ideal New. 3/60/220/440/1800

2—20 HP Louis Allis ES. 365 3/60/220/440/1800 X-Proof

15 HP Louis Allis EX-364 360/220/440/1800 X-Proof.

125 VOLT DC MOTORS

1—100 HP Crocker Wheeler 125 Volt DC 850 RPM Ball Bearing

1—150 HP Crocker Wheel 125 Volt DC 850 RPM Ball Bearing.

Will make 1200 RPM 125 Volt Generators.

DC CIRCUIT BREAKERS

1—1000 AMP. Condit. 2 Pole

1—1600 AMP. Condit. 2 Pole

1—1600 AMP. Westinghouse 2 Pole

1—3000 AMP. Westinghouse 2 Pole

333 KVA TRANSFORMERS

4—333 KVA Gen. Elect. Transformers Type H Form VRW Primary 2400/4800 Secondary 240/480 Single Phase 60 cycle with Taps Immediate Shipment.

REBUILT TRANSFORMERS

3—100 KVA Pittsburgh 1/60/4800/230/460

3—75 KVA Pittsburgh 1/60/2300/4000Y/230/460

3—50 KVA Moloney 1/60/4800/230/460

3—50 KVA Westinghouse Type S. 1/60/2300/230/460

3—100 KVA G.E. 1 ph., 60 cy. 2400/4160 pri. 120/240 sec.

3—1667 KVA Wagner 1 ph., 25 cy., 23,000 pri., 575 sec.

ERIE ELECTRIC CO., INC. 124 CHURCH ST. BUFFALO, N. Y. CL. 4758

MOTOR GENERATOR SETS

Two 75 KW GE 250/125 v—3/60—220/440 v

NON-CONDENSING TURBO UNITS

1563 KVA GE 3/60-2300 v
937 KVA GE 3/60-480/240 v
625 KVA Al. Chal. 3/60-480 v—Elliott
300 KVA Al. Chal. 3/60-480 v—Elliott
250 KVA GE 3/60-480/240 v
125 KVA GE 3/60-480/240 v
125 KVA GE 3/60-480/240 v—30# bp
62 KVA GE 3/60-240 v
20 KVA GE 3/60-240 v—Terry

BLEEDER TURBO UNIT

1563 KVA GE 3/60-2300 v—250#—12# bp

MODERN DIESEL UNITS 480/240 V.

375 KVA Elec. Mchy-Buckeye 8 cl.
312 KVA (2) Wghse-Worthington 6 cl.
250 KVA Elliott-Buckeye 5 cl.
220 KVA (2) Wghse-Buckeye 7 cl.
187 KVA Ideal-Buckeye 6 cl.
75 KVA (2) General Motors
50 KVA GE-Caterpillar
50 KVA (2) GE V belt—60 HP F.M. 42F
37 KVA General Motors

125 KVA (2) General Motors Model 268A, 440/220 volts, 1200 RPM; dir. con. exciters, Switchboards (Never Used.)

BOILERS

45000 LB (3) B&W-F19 integral Furnace, 275#
30000 LB (2) Combustion Engr. (package) 250#
309 HP Comb. Engr. 160#
300 HP Keeler, CP 300#
255 HP (2) Comb. Engr. 200#
125 HP Erie City (packaged VL) 200#

POWER PLANT EQUIPMENT CO., INC. 39 Cortlandt St. New York, N. Y.

BOILER FEED PUMPS

1—Lecourtenay 675 G.P.M., Type 4M 8B, 5 stage, 1100 Ft. Hd.
1—Worth. 740 G.P.M., type WCS-2, 5", 2250 Ft. Hd.
1—Worth. 700 G.P.M., type UNS-1, 6 stage, 6". 1550 Ft. Hd.
2—I. R. 200 G.P.M., 2", 1375 Ft. Hd.
Pumps above are mounted on basis for motor or turbine drive.

We have about 200 various size cent. pumps on hand, turbine, motor, and gasoline driven. Send us your inq.

DALTON SUPPLY CO.
2829 Cedar St. Phila. 34, Pa.

ELECTRICAL CABLE

- For every industrial and power application.
- Special constructions. Odd lengths.
- Large stocks on hand of high voltage, lead covered cables not ordinarily stocked by your regular suppliers.
- Cut to length. Reasonably priced.

UNIVERSAL WIRE AND CABLE CO.
2668 N. Clybourn Ave., Chicago 14, Ill.

—TRANSFORMERS—

BOUGHT AND SOLD

We carry a large stock of transformers, and invite your inquiries. New Transformers built to your specifications.

PIONEER TRANSFORMER REBUILDERS

We rewind, repair and redesign all makes and sizes.
One Year Guarantee.

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
SINCE 1912 CINCINNATI 27, OHIO

REFRIGERATION UNITS

TWO PRACTICALLY NEW WORTHINGTON CARBONDALE

REFRIGERATION COMPRESSORS

300 Ton Freon

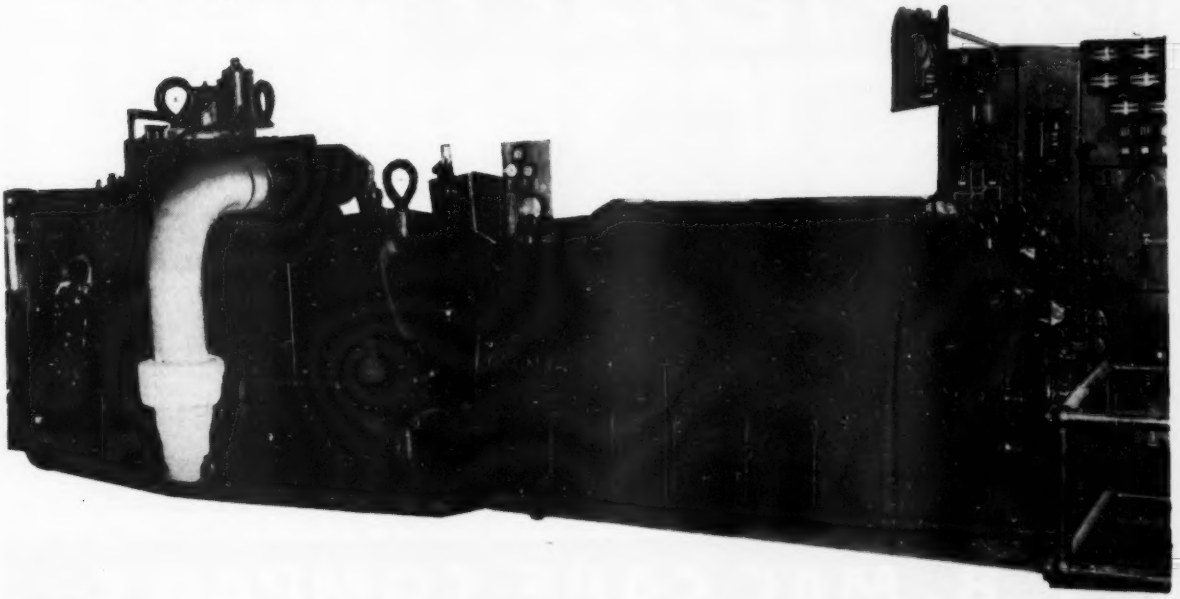
Ideal for large plant or office building

WILL SACRIFICE

WINSTON MACHINERY CO., INC.
326 WEST OHIO STREET
INDIANAPOLIS, INDIANA

3000 KW., 400# psig., WESTINGHOUSE, 700°F.TT. Turbo-Generator

A Complete Perfect Condition Unit: IMMEDIATE DELIVERY



Above is Westinghouse Condensing 3000-KW. @ 80% PF., 3750-KVA., 400# psig., 700°F. TT., Voltage 3/60/2300/4160. Auxiliaries, 5500-sq. ft. Westinghouse, 2-pass Surface Condenser, Switchboard with Instruments with DC. Control Panel, 35-KW. Direct Connected Exciter. 3500-GPM. Circulating, also Condensate, pumps, both Motor Separated, set of 2-stage Air Ejectors. A Very High Grade Unit in Splendid Condition throughout. Send for Drawings Today. Immediate Delivery.

OUR SPECIALTIES: Turbo-Generators, Boilers, Diesel Engines. We Carry Large Stocks in These Three (3) Lines at all Times.

BELOW IS A PARTIAL LIST OF OUR PRESENT STOCK.

TURBO-GENERATORS: ALL 3600 RPM

CONDENSING

No.				
1	500-KW.	A.-C.	150/200 psig.	480-V
2	500-KW.	G.-E.	150/200 psig.	480-V
3	625-KW.	G.-E.	160/200 psig.	480-V
4	750-KW.	A.-C.	150/200 psig.	480-V
5	750-KW.	West.	140/200 psig.	2300-V
6	750-KW.	Elliott	150/200 psig.	480-V
7	750-KW.	A.-C.	150/200 psig.	2300-V
8	750-KW.	G.-E.	150/200 psig.	480-V
9	1000-KW.	G.-E.	175/250 psig.	2300-V
10	1000-KW.	A.-C.	125/200 psig.	2300-V
11	1500-KW.	A.-C.	150/200 psig.	2300-V
12	2000-KW.	G.-E.	175/200 psig.	2300-V
13	2000-KW.	G.-E.	150/200 psig.	2300-V
14	2500-KW.	G.-E.	150/250 psig.	2300-V
15	3000-KW.	G.-E.	150/250 psig.	480-V
16	5000-KW.	G.-E.	150/200 psig.	2300-V

NON-CONDENSING

No.				
1	500-KW.	A.-C.	125#:10/15 BP.	480-V
2	500-KW.	G.-E.	175#:10/15 BP.	480-V
3	500-KW.	West.	250/400:125# BP.	2300-V
4	750-KW.	G.-E.	125#:10# BP.	480-V
5	1000-KW.	G.-E.	125#:15 BP.	480-V
6	1250-KW.	G.-E.	200/250 psig. 20# BP.	480-V
7	2000-KW.	West.	250/350#:35# BP.	2300-V
8	2500-KW.	G.-E.	150/175#:15# BP.	2300-V
9	3000-KW.	West.	425#750F:60# BP.	13200-V
10	4000-KW.	G.-E.	425#, 75° FSH. 60# BP.	13200-V

BOILERS, ETC.

1—Springfield, Same as NEW, 615-HP., 42,500# Steam per Hr., operated 60 days only. Working pressure 275#. Riley Stoker. Complete with all Trim.

2—B&W, 1000-HP, 225 working pressure. Excellent condition.

2—B&W, 604-HP., Good for 25%—Continuous overload rating or 750-HP. Above are Sectional Headers.

PLEASE SEND YOUR SPECS. FOR: DIESEL ENGINES, BOILERS, MOTOR GENERATORS, PUMPS.

Our New Complete Stock List Just Recd. A Postal Brings it.

TELEPHONE
WRITE OR
TELEGRAPH

CHARLES WEAVER

4145 Penobscot Building, Detroit 26, Michigan

Telephones:
WO. 1-1340
" 1-1341
" 1-6038

MOTORS—M. G. SETS—TRANSFORMERS

ENGINEERED AND REBUILT BY EXPERTS IN OUR OWN PLANT

SYNCHRONOUS MOTORS

Qu.	H.P.	Make	P.F.	Volts	R.P.M.
1	6000	G.E.	100	2300	90
1	3000	Whse.	80	4800/2400	720
2	2100	G.E.	100	2300	360
2	1750	G.E.	100	2300	3600
1	750	G.E.	80	2300	450
1	600	G.E.	100	440	360
1	700	G.E.	80	2300	720
1	250	G.E.	100	2300	514
1	200	Whse.	80	440	1200
1	187	G.E.	80	440	720
1	150	G.E.	100	2200	900
1	150	G.E.	100	550	600
1	120	G.E.	80	550	450
2	135	G.E.	80	4000/2200	1200
3	125	El. Mchy.	100	4800/2400	900
1	125	G.E.	80	2200	900
2	100	Whse.	80	440	1800
1	100	Ideal	80	440	900
2	100	G.E.	80	440	600

With these we can supply—Manual, Semi or full magnetic reduced or full voltage control.

SQUIRREL CAGE MOTORS

3-Phase — 60 Cycle

Qu.	H.P.	Make	Type	Volts	R.P.M.
1	400	Cont.	NZ-806	2300	1200
1	400	G.E.	I-K	2200	v514
1	400	G.E.	KT-412	2200	450
1	200	Whse.	CS-890	2300	1780
1	200	Whse.	CS-873-C	2200	1200
1	200	Al.Ch.	ARY	440	600
2	125	Al.Ch.	AR	2200	1750
1	125	Al.Ch.	AR	2300	514
1	125	C.W.	126-Q	440	430
2	100	Whse.	CS-663-C	440	1750
1	100	Al.Ch.	AR	550	720
3	100	Whse.	CS-938	2200	514
1	100	F.M.	H-241	440	450
2	75	Al.Ch.	AR	2200	1705
1	78	G.E.	I-K	440	600
1	75	Al.Ch.	AR	2200	720

Special—1 (new) G.E. Vertical KF-574, 2200-Volt 580 R.P.M., enclosed, hollow shaft.

MOTOR GENERATOR SETS

Qu.	KW	Make	RPM	Volts DC	Volts AC
1(3-U)	2400	Whse.	720	600	2400/4800
2	1500	G.E.	600	600	4150/2300
3	1000	Whse.	514	600	11000/6600
4	1000	G.E.	514	600	11000/6600
1	1000	G.E.	514	600	2300
2	500	C.W.	720	375	2300/440
1	400	C.W.	1200	125/250	440/2300
2	250	Whse.	1200	125/250	2300
1	200	Ridgway	900	275	2300
2	200	Whse.	1200	125/250	440
1	155	G.E.	720	250	2300/440
2	150	Whse.	1200	250	2300
1	100	Al. Ch	1200	125/250	4000/2300
1	100	Delco	1200	125/250	440/220
1	100	Ridgway	1200	275	4000/2300
1	100	C.W.	1200	125	440/220
1	85	C.W.	1200	250	440/220
1	75	Al. Ch.	900	250	2300
1	75	Whse.	900	75	2300
1	25	Ideal	1750	125	220
1	25	Al. Ch	1200	250	440/220

We can furnish any of these sets with exciters and VARIABLE VOLTAGE CONTROL engineered and rebuilt to your requirements.

Motor Generators of modern design, complete with control—still on their original foundations—available for immediate shipment.
(3)—G. E. 1500-KW, 250-VDC, 514 R.P.M., cpd., interpole, pole face windings, 2100-HP syn. motors, .8-PF, 13,200-V, 3-p, 60-cy. will reconnect to 6600-V. or 4160-V.

TRANSFORMERS

Qu.	KVA	Make	Type	Phase	Voltage
3	833	Whse	OISC	1	66000/39400-2300/4160
1	2750	G.E.	H	3	13,800-2400/4160Y
3	250	Packard	A	1	13,200-2200
3	150	Packard	A	1	2300-230/460
3	100	G.E.	H	1	33,000-2300
3	25	G.E.	H	1	2400-120/240
40(new)	3	Al.Ch	OISC	1	2400-120/240

SLIP RING MOTORS—CONSTANT DUTY

3-Phase — 60 cycle

Qu.	H.P.	Make	Type	Volts	R.P.M
1	1800	G.E.	MT 498	2300	357
1	1200	G.E.	MT 26	2200	277
2	1000	Al.Ch.	ANY	2200	235
1	800	G.E.	MT	2200	440
1	700	Whse.	CW	2300	720
1	600	G.E	MT 20	2300	360
1	500	Al.Ch.	ANY	2200	514
2	500	G.E.	I-16-M	2300	450
1	400	G.E.	MT 412	2200	440
1	250	Whse.	CW 937	440	1200
1	250	Al.Ch.	ANY	440	720
1	250	G.E.	MT 414	2200	300
1	125	Whse.	CW 870	2200	900
1	100	Whse.	CW 766	440	1200
1	100	F.M.	H 20 C	440	900
2	100	G.E.	I-15A-M	2300	514

DIRECT CURRENT MOTORS

Qu.	H.P.	Make	Type	R.P.M.
1***	3000	Whse.	Encl. (Rev.)	600
1***	2400	Whse.	Encl. (Rev.)	600
4***	1500	Whse.	Encl. (Rev.)	600
4***	1200	Whse.	Encl. (Rev.)	600
4***	800	Whse.	Encl. (Rev.)	600
1	350	G.E.	CD-169-A	1150
1	200/250	El. Dy	No. 22	400/1200
1	250	G.E.	MPC	325/975
1***	200	G.E.	MPC	540/1200
1	200	Whse.	Mill	300/1200
1	180	G.E	MPC	400
1***	125	Whse.	SK-190	600
2	125	Whse.	SK-184	575/850
1	90/160	G.E.	MPC	625/1125
1	100	Rel.	1050T	400/1200

All above 230-VDC except where marked***
***—Pedestal bearing mill design 525/600-VDC.
Rev.—designed for mill reversing service.

T. B. MAC CABE COMPANY

4314 CLARISSA STREET — Phone DAvenport 4-8300 — PHILADELPHIA 40, PENNA.

POWER PLANT EQUIPMENT

SPECIAL OFFERINGS

TURBO-GENERATORS

1—20,000 KW, 250# 13,200 V.
1—10,000 KW 200# 13,800 V.
1— 5,000 KW 275# 11,500 V.
1— 4,000 KW 400# 2300 V.
1— 3,000 KW 425# 13,200 V. Ext. 170# Non Cond.
1— 3,500 KW 175# 550 V. Cd.
1— 1,500 KW 150# 2300 V. Cd.
1— 1,500 KW 175# 550 V. Ext.
1— 1,250 KW 250# 2400 V. Ext.
1—1,000 KW 200# 4160 V. N.C. NEW 1949.
2— 750 KW 150# 250 V. D.C.
1— 500 KW 200# 4160 V. N.C.
1— 300 KW 125# 250 V. D.C.
2— 120 KW 150# 240 V. N.C.

DIESEL GENERATORS

1—1000 KVA 2400 volts
3— 500 KW 480 volts
1— 400 KW 480 volts
1— 300 KW 2400 volts
2— 75 KW 240/480 V.

BOILERS

2—50,000# 275# (1949)
3—15,000# 275# (1945)
1—300 H.P. 250# (1938)
2—250 H.P. 200# (1940)
1—84" HRT 150# (1942)

CRANE

1—16 Ton Span 30'-10½" Hand operated

Write or wire for additional data and prints.

A. LEE ELLIS CO., U. S. Machy. Bldg., 140 Federal St., Boston 10, Mass.
THE BUYERS MUST BE SATISFIED—ALWAYS

DIESEL GENERATOR SET

600 KW D.C. GENERAL MOTORS, Model 12/567, Westinghouse Generator, 500 volt, 720 RPM, Electric Start. Unused.

Various sizes in stock, AC & DC Units.

ALJON ELECTRIC DIESEL CO.
904-10 Pacific St., Brooklyn 38, N.Y. ST 3-6515

NOW LIQUIDATING

Equipment from Closed Brewery Marion, Indiana

1—I-R 7x7 Air Compressor, 15 HP motor.
1—Carbondale 10x10 Vert. twin cylinder Ammonia Compressor, 82 ton, 75 HP motor.
1—Carbondale 9x9 Vert. twin cylinder Ammonia Compressor, 60 ton, 60 HP motor.
1—Taber Fermentation Gas Collector with 8 storage tanks 50 cu. ft., ASME 245# WP.
5—Niagara Spray Cooler and Fan Cooler Units.
1—Rotary Pump 5", with 40 HP motor, 1000 GPM —86' Hd.
3—Westinghouse Dry Type Transformers, 100 KVA & 150 KVA.
Lot of Welded Steel Storage Tanks (closed) 5500 gal., 10,500 gal., 11,300 gal. and 12,700 gal.
Lot of Welded Steel Tanks, 16'10" L x 7'7" W x 8'9" deep, open top, flat bottom.

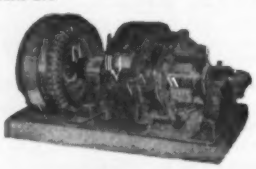
FOR SALE FROM PHILA. STOCK

2—I-R Meterblowers, type FS-538; cap. 4000 CFM @ 3# Pr.
1—Penn Steam Booster Compressor 4x5
1—Terry Steam Turbine, 10 HP
1—Coppus Steam Turbine, 8 HP
1—Byron Jackson Bronze Deep Well Turbine Pump with 20 HP motor. 150 GPM.
1—I-R #5-ALV Bronze Centrifugal Pump with 40 HP motor. 850 GPM—140'.
1—I-R #1½-RVH Bronze Centrifugal Motorpump with 20 HP motor. 200 GPM—200'.

PERRY EQUIPMENT CORP.
1422 N. 6th St. PHILA. 22, PA.

LATE TYPE MOTOR — GENERATOR SET

500 KW, 240 volt D.C., 900 RPM. Westinghouse Compound Wound. Serial No. 4979932. 714 HP, Syn. Motor 3/60/2200 volt, 80% P.F. Serial No. 4979926. With Mag. Reduced Voltage Starter. Factory Built Set.



MECHANICAL SPEC.
Base: 125¼" long and 50" wide
Overall Height: 80¾"
Weight: 21,600 lbs.

BENSON-WILIMZIG, INC.
1708 North Eighth St., St. Louis 6, Mo.
Phone Garfield 4210

GET A COMPRESSOR

STATIONARY — PORTABLE from COMPRESSOR MEN

20 LBS. to 3000 LBS.—
30 CFM to 2500 CFM

ELECTRIC—STEAM—DIESEL—GAS

AMERICAN 50 YEARS' RECORD GUARANTEES SATISFACTION

Have Your Compressor Rebuilt By Compressor Men

Sell • Buy • Trade • Rent

AMERICAN AIR COMPRESSOR CORP.
Dell Ave. & 47th Street
North Bergen, New Jersey

BOSWICK ELECTRIC CO.

MOTORS

REBUILT D.C. 230 VOLTS

HP	RPM	Mfg.	Brgs.
100	450/1350	Whse.	Sl.
50	200/800	E-D	Ball
50	300/900	G.E.	Sl.
50	400/1200	Rel.	Sl.
35	400/1200	Ideal	Sl.
30	250/1000	Whse.	S. Sl.
30	350/1050	Whse.	Sl.
30	500/1500	Rel.	Ball
30	600	Whse.	Sl.
25	300/1200	Rel.	Ball
25	500/1500	C-W	Ball
25	600/1350	Rel.	Ball
20	250/1000	West.	Sl.

150 Motors 5 to 150 HP.

SLIP RING

HP	RPM	Volts	Mfg.
400	300	2300	G.E.
350	450	2300	Whse.
100	1160	440	G.E.
100	1800	440	G.E.
50	720	220	Whse.
40	900	220	G.E.

SYNCHRONOUS

HP	RPM	Volts	Mfg.	Type
1400	1200	450	West.	100%
720	900	2300	West.	100%
200	200	440	G.E.	80%
200	1800	440	West.	100%
150	600	440	G.E.	100%
150	720	2200	G.E.	80%
150	900	220	G.E.	100%

AIR CIRCUIT BREAKERS

10—1200 ampere, 3P 2T, 600 volt I-T-E air circuit breakers.

M. G. SETS

KW	D.C. Volts	A.C. Volts	Mfg.
500	125/250	2300	Whse.
400	125/250	2300	Whse.
300	250	2300	G.E.
200	250	550	Whse.
150	250	440	Whse.
100	275	2300	Whse.
40	250	220/440	G.E.
30	125/250	2300/4000	G.E.
9	125	220/440	Burke
7½VS	250	220/440	Rel.
3VS	250	220/440	Rel.

A.C. CONTROLS

1—500 HP, 4600-3-60, G.E. CR-1034, man. red volt. starter.
1—150 HP, 2200-3-60 Roller Smith mag. red. volt. starter, auto-transformer type.
1—150 HP, Allen Bradley 220-3-60 magnetic, reduced voltage starter.
1—100 HP, 440-3-60 G.E. CR-7022Y1 wound rotor controller.
2—Size 5 G.E. magnetic starters, 220 or 440 v., NEMA 1 encl.

D.C. CONTROLS 230 volts

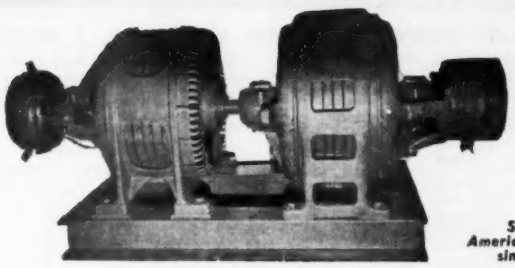
2—200 HP G.E. magnetic reversing, dynamic braking starters.
1—125 HP Clark magnetic adjustable speed starter.
1—New 100 HP Monitor magnetic, adj. speed starter.
1—Westinghouse 75 HP, reversing, dynamic braking starter.
3—75 HP Cutler-Hammer plain magnetic starter, NEMA 4 encl.
1—50 HP Ward Leonard mag. adj. speed starter, dyn. braking.
1—New G.E. 30 HP variable voltage controller CR 3270Y1, reversing, dynamic braking.
1—30 HP G.E. Planer Control CR 4630Y1, reversing dyn. braking.
(We can assemble any type D.C. control to your specifications)

BOSWICK ELECTRIC CO.

P.O. BOX 55 AKRON 9, OHIO
Telephone—WAlbridge 8-1195

WAGNER

CERTIFIED REBUILT



Serving American Industry since 1906

"Check with WAGNER FIRST"

PARTIAL LISTING OF LARGER ITEMS IN STOCK

A. C. MOTORS

H.P.	Mfr.	Type	Volts	Speed
750	Whse.	Synch.	2200/4000	900
700	G.E.	Synch.	2200	514
600	G.E.	Synch.	220/440	257
500	G.E.	Sq. Cage	6600/4000	1800
500	G.E.	Synch.	440	900
500	G.E.	Slipring	2200/440	450
500	Al. Ch.	Synch.	440	400
450	Whse.	Synch.	2300	900
400	G.E.	Synch.	440	450
350	Whse.	Slipring	2300	450
350	G.E.	Slipring	440	720
300	Al. Ch.	S. Cage	2200/440	720
300	El. Mach.	Synch.	2200/440	360
300	G.E.	Sq. Cage	2300	1800
300	Whse.	Synch.	2200/440	600
300	G.E.	Slipring	2300	1800
300	Al. Ch.	Slipring	2300	514
300	G.E.	Slipring	440	360
250	G.E.	Slipring	2300	450
250	G.E.	Slipring	440	600
250	Whse. (2)	Sq. Cage	2200/440	1200
250	L.A. (2)	Sq. Cage	2200	1800
225	E.M.	Synch.	440	1800
225	G.E.	Synch.	220/440	600
200	G.E.	Sq. Cage	220/440	600
200	Cr. Wh.	Sq. Cage	220/440	3600
200	Whse.	Sq. Cage	2200/440	900
200	G.E.	Slip Ring	220/440	600
200	E.M.	Synch.	220/440	1200
200	G.E.	Sq. Cage	220/440	1200
200	G.E. TEFC	Slipring	220/440	1200
200	Al. Ch.	Synch.	440	360
200	G.E.	Slipring	220/440	360
200	G.E.	Sq. Cage	220/440	1800
200	Rel. b.b.	Sq. Cage	220/440	1200
200	E.M.	Synch.	220/440	514
160	Whse.	Synch.	220/440	600
150	G.E. TEFC	Sq. Cage	2200	3600
150	Al. Ch.	Sq. Cage	2200	3600
150	G.E.	Slipring	220/440	600
150	Rel. b.b.	Sq. Cage	220/440	1200
150	Al. Ch.	Slipring	2200/440	720
150	G.E. (2)	Sq. Cage	2200/440	720
150	G.E.	Slipring	220/440	450

A. C. GENERATORS — 60 CYCLE

KVA	Mfr.	Type	Volts	Speed
1000	Whse. syn. cond.		4000/2300	900
625	Gen. Elec.	ATB	2300	450
625	G.E. 25 cycle	ATB	2300	750
600	Gen. Elec.	ATB	480	900
625	El. Machy.	Late	240/480	1200
485	Allis. Ch.	1 brg.	480	400
375	G.E.	ATI	240/480	1200
350	El. Machy.	1 phase	480	1200
312	Gen. Elec.	ATB	240/480	600
275	G.E. 25 cycle	ATI	480	750
225	Gen. Elec.	ATB	240/480	600
150	Whse.		2300/480	600
125	Gen. Elec. (2)	ATB	240/480	900
112	Gen. Elec.	ATB	240/480	900
75	El. Machy.		2300	900
56	G.E.	ATB	240/480	1200

M-G SETS

KW	Mfr.	Input V		Output V
500	Whse.*	2300	AC	250 DC
360	G.E.*	2300/4000	AC	250 DC
300	Whse.*	2300	AC	600 DC
250	Allis. Ch.	440	AC	350 DC
200	G.E.*	220/440	AC	250 DC
200	Gen. Elec.*	220/440	AC	125 DC
150	Whse.*	220/440	AC	125/250 DC
105	Century b.b.	220/440	AC	70 DC
100	Whse.*	2300/4000	AC	275 DC
100	Al. Ch.	220/440	AC	125 DC
100	Delco b.b.	220/440	AC	125/250 DC
100	Allis Ch.*	220/440	AC	50 DC
60	Gen. Elec.*	220/440	AC	60 DC
50	Gen. Elec.	220/440	AC	125 DC
50	Allis Ch. (2)	220/440	AC	125/250 DC
45	Gen. Elec.*	220/440	AC	60 DC
40	Gen. Elec.	220/440	AC	250 DC
30	Otis (5)	220/440	AC	250 DC
25	Whse.	220/440	AC	125 DC
20	N.W.	220/440	AC	250 DC
20	Whse.	220/440	AC	600 DC
21	Whse.	220/440	AC	35 DC
17	Gen. Elec.	220/440	AC	125 DC

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
300	Whse.	SK	600	900
250	Allis Ch. b.b.	EW	350	1200
150	Whse.	SK191	125/250	900
125	Gen. Elec.	RC38	250	675
105	Century b.b.	1500 amp.	70	1200
100	Whse.	SK	250	900
100	Allis Ch.	E	125	1200
60	Gen. Elec.	LC	250	700
50	Allis Ch.	E131	250	1200
50	Allis Ch.	EW	125/250	1200
50	Gen. Elec.	RC	125	1200
40	Gen. Elec.	RC	600	1750
40	Gen. Elec.	RC	250	1150
25	G.E. b.b. New	CDM93	125	1500
20	Gen. Elec.	RC	125	1150
15	Star b.b. (10)	SQ	250	1500

D. C. MOTORS

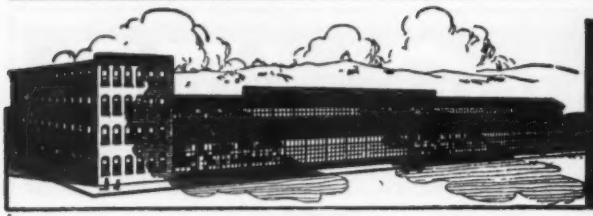
HP	Mfr.	Type	Volts	Speed
300	Gen. Elec.	MPC	250	500
300	Allis Ch. b.b.	EW	350	1000
200	Al. Ch. b.b.	E	250	600/1000
150	Reliance	1050T	230	1200
150	Gen. Elec.	RC39	230	550
100	Whse.	SK	230	400/1200
100	Cr. Wh. b.b.	JH	115	1150
60/75	Gen. Elec.	C	230	500/1200
50	Gen. Elec.	CD123	230	550/1200
50	Al. Ch.	E-131	230	1150
50	Gen. Elec.	RC33	115	1100
40	Gen. Elec.	RC32	230	1100
36	Gen. Elec.	LC	230	500/1500
30	Whse.	SK110L	230	1150
30	Star b.b. (3)	SB	230	1750
25	Whse.	SK150	230	300/1200
25	G.E. b.b.	CDM93	115	1150
20	Whse. b.b. (2)	SK97	550	900

QUICK SHIPMENT FROM STOCK — LOW PRICES — FULL GUARANTEE

Gearhead Motors — Controls — Transformers

Arthur Wagner Co.

1435 W. RANDOLPH ST. MOnroe 6-7409 CHICAGO 7, ILLINOIS



GLOW ELECTRIC CO.

927 HARRIET ST. CINCINNATI 3, OHIO
PHONE MAIN 3024

MEMBERS OF AMERICAN REBUILDERS ASSOCIATION, A MEMBER BODY OF AMERICAN STANDARDS ASSOCIATION

SQUIRREL CAGE, OPEN 3 PHASE MOTORS

HP	RPM	VOLTS	DESCRIPTION
750	900	6600	Westinghouse
350	3600	2200	Westinghouse
300	1200	2300/440	Westgh., CS
300	900	440	G.E.
200	490	2200	G.E.-I
125	3600	220/440	A-C
125	1800	2200	A-C
115	1200	440	G.E.
100	1800	2200	Westinghouse
100*	1200	2200	G.E.-KF544
100	1200	2300/440	A-C, AR.
100	720	440	Westgh. 3 Brg.
85	3600	2200	G.E.
60	3600	2200	G.E.
60	1800	2200	G.E.
50	3600	220/440	G.E.-404S
50	1800	220	Triumph
50	720	2200	Westinghouse
40	1800	220/440	West.-444
40	900	440	G.E.
40	720	440	G.E.
35	3600	220	G.E.-KT
35	600	440	G.E.
30	3600	220/440	Westgh., 364
30	1800	440	GE-KT323
30	720	220	G.E.
30	514	440	Stanley
25	3600	220/440	L-A
25	1800	220/440	A-C, Fr. 365
25	1200	220	A-C, AN
25	900	440	G.E.
25	800	440	G.E.
20	3600	440	A-C
20	1800	220/440	G.E.
20	1800	220/440	G.E.
20*	1800	220/440	Westhe.
20	1200	220	Westgh., CS
20	900	440	A-C
20	600	220	G.E.
15	3600	220	G.E.
15	1800	220/440	G.E.
15	1200	220	Imperial
15	900	220	Howell

*New Motors

4 SPEED MOTORS AND CONTROL

Century, Model SCNM504Y901AV, 20 HP, 440 volt, 3 Phase, 60 Cycle, 1700/1120/870/560 RPM, Multi-speed, ball bearing. With plugging switch mounted on shaft; motors on adjustable hinge bases. Control —Allen Bradley, Magnetic.

SLIP RING MOTORS

HP	RPM	VOLTS	DESCRIPTION
400	514	440	West.-CW
375	1800	2300	Al. Ch.
350*	514	440	G.E., TE, FC, BB
300	514	440	Al. Ch. 3 Brg.
250	600	2200	G.E.-117B
250	450	2200	C.-W.
250	450	2200	G.E.-I-17B
250	300	2200	Al. Ch.
200	1800	440	Al. Ch.
200	600	440	West.-CW
200	600	440	G.E.-IM
200	514	440	West.-CW
150	1800	2200	FM-HV
150	720	2200	Al. Ch.
150	600	220	Wagner
125	1750	2200	West., CW
120	900	550	Ideal
100	720	440	Al. Ch.
100	600	2200	G.E. MT-562
100	600	220	Wagner
100	400	440	West. Elec. (GE)

*New

MOTOR GENERATOR SETS

D.C. OUTPUT KW	Voltage	Description	A.C. INPUT HP	RPM	Volts
1500	900	G.E., MCF	2100	720	13200
1200	525	Al. Ch.-G.E.	2000	720	2300
800	500	West., 3 unit	1200	1200	2300
800	250	Westgh.	1200	1200	2300
750	550	G.E.	1070	900	2300
750	500	Westgh.	1070	900	13200
750	250	Westgh.	1070	900	13200
600	250	Westgh. (2-300KW Gen.)	1200	1200	2300
600	250	G.E.	900	900	2300
400	250	Westgh.-G.E.	600	1200	220/440
300	250	G.E.	450	1200	2300
200	125	G.E.,-Westgh.	300	720	2300
200	125	G.E. (25 cy.)	300	750	440
200	250	G.E.,-Westgh.	300	1200	440
100	250	Delco-Westgh.	150	1200	220
100	250	G.E.	150	1200	220/440
75	125	G.E.	115	1200	440
50	125	C-W	85	1800	440
47½	125	Al. Ch.	100	1200	2300
40	250	Westgh.-G.E.	60	1200	220/440
35	125	G.E.	50	1800	2200
22	125	Al. Ch.	33½	900	220
20	115	G.E.-Al. Ch.	30	900	220
15	250	Al. Ch.-L.A.	25	1800	220/440

PLATING AND ANODIZING SETS

D.C. OUTPUT AMPS	VOLTS	RPM	DESCR.	HP	A.C. END VOLTS	DESCR.
4000	2 to 8	425	Jantz & Leist			
2400	40/80	1200	Westgh.	290	440	WH Sync.
1500/750	6/12	1200	Munning Loeb	15	440	GE—1 Cage
1200	60	1150	Century	106	220/440	Century, SCN-584
1000	60	1200	Century	100	440	Century Cage
1000	6	1200	Wagner	—	—	—
800	30	900	C-W	40	220	C-W type 122Q
680	11	900	Westgh.	15	440	W.H. BB.
600	50	900	E-M	40	440	A-C
600	30	1200	W-E	30	440	GE
600	30	900	G.E.	25	440	GE
500	40	1200	G.E.	30	440	GE-KT
500	12	1200	Ideal	10	220	GE-KT
500	6		GE Rectifier	—	440	—
416	12	1200	HVW	7½	440	GE-KT
400	40	1800	Hobart	25	220/440	Hobart
208	62	1800	G.E.	20	220/440	GE-KT

COMPLETE POWER PLANTS

STEAM — ELECTRIC — HYDRO — DIESEL

"Export Orders Carefully Executed"

FOR IMMEDIATE DELIVERY

TURBO-GENERATORS—Condensing—500 to 20,000 KW; some extraction type, pressures 200 to 450#. *ON WHAT SIZE SHALL WE QUOTE?*
TURBO-GENERATORS—Non-condensing—300 to 3000 KW. 150# to 450#. some extraction with high back pressure. *WHAT SIZE INTERESTS YOU?*
STEAM GENERATORS—30000# to 100000# per hr. 150# to 450#.
BOILERS—Water Tube, Stirling & Straight Tube types 200 to 450#.
Special 2 500 H.P. B&W Co. Stirling Boilers 200#—excellent condition.
BOILERS—Fire Tube, 100 to 300 HP. 100 to 250#. *WHAT BOILERS?*

TRANSFORMERS Quick Delivery, Various Sizes Rebuilt like NEW—Guaranteed. Motor-Generators, Rotaries, Frequency Changers, Large Motors & Diesel Generators.

Send us your **INQUIRIES** *for* **ALL POWER MACHINERY**

CHARLES B. REARICK **30 CHURCH ST.** **NEW YORK 7, N. Y.**

A.C. MOTORS (3 Ph. 60 Cy.)

HP	MAKE	VOLTS	TYPE	SPD.	WDG.
400	Al. Ch.	2200		514	S.R.
400	G.E.	2200	MT	450	S.R.
300	G.E.	2200/4000	IM	450	S.R.
200	West.	220	CW	600	S.R.
150	G.E.	220/440	ATI	600	Syn.
125	West.	220		277	Syn.
100	G.E.	440	IM	450	S.R.

D.C. MOTORS (250 V.)

HP	MAKE	WDG.	TYPE	SPD.
400	G.E.	Cpd.	MPC	1000
300	Cr. Wh.	Cpd.	CCD	1000
200	Triumph	Cpd.		450
150	G.E.	Cpd.	DLC	800
75	G.E.	Cpd.	RC	600
60	West.	Cpd.	SK	435
20/25	West.	Series	K5	975/875
6¼/7½	West.	Series	K3	680/585

M-G SETS

400 KW	West.	720 RPM 600 V.	Syn. 3/60/2300 v.
300 KW	G.E.	1200 RPM 250 V.	Syn. 2300/4000 v.
240 KW	G.E.	1200 RPM 250 V.	Syn. 2300/4000 v.
225 KW	G.E.	1200 RPM 125 V.	Syn. 2300/4000 v.
150 KW	G.E.	1200 RPM 250 V.	Syn. 2300/4000 v.
100 KW	Rldg.	1200 RPM 250 V.	Syn. 2300/4000 v.
75 KW	West.	1200 RPM 250 V.	Syn. 220/440 v.
50 KW	G.E.	1200 RPM 250 V.	Sq. Cg. 220/440v.
35 KW	G.E.	1800 RPM 125 V.	Sq. Cg. 220/440v.

MOORHEAD ELECT. MACH'Y. CO.
P.O. Box 7991P **Pittsburgh 16, Pa.**

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Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

PENN MACHINERY COMPANY
Jackson, Miss.

150-200-250 HP Slip Rg. Motors—600 RPM
Reclosing C. Breakers—600 to 2000 Amps.
150 & 250 HP Self-contained Boilers
Filter Presses—Oliver Unused—Shriver
5—20 HP Slip Rg. Motors TCDPBB
300 & 400 HP Low Head WT Boilers
4' Symons Cone Crusher—Revamped

H. & P., 6719 Etzel Ave., St. Louis 14, Mo.

FOR SALE BY OWNER

2000-KW., WESTINGHOUSE NON-CONDENSING TURBO-GENERATOR.

Now Nozzled for 250# psig., 20# Back Pressure, 3/60/2300-V. With Moderate Changes Good for 400# psig., 50# Back Pressure. Condition GOOD. Complete Unit with Direct Connected Exciter, Switchboard, etc. *Immediate Delivery.*

ADDRESS FS-6617, POWER
330 WEST 42nd ST., NEW YORK 36, N. Y.

VARIABLE SPEED DRIVES
FREQUENCY CHANGERS
LOW-VOLTAGE GENERATORS
American ELECTRIC CORPORATION
DEPT. P, Box 133, INDIANAPOLIS, IND.

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BOILER

1037 HP-700 lb. B & W Type IF Spreader Stoker.

Complete Accessories and Auxiliaries.

MERRILL and COMPANY
407 S. Dearborn St. Chicago 5, Ill.
Telephone HArrison 7-8289

BREW-WOLTMAN OFFERS

TURBINE UNITS

1—5000 KVA West. 3/60/420 V. 3600 RPM EXTRACTION nozzled for 385 psig 550° TT, 2 extraction openings 80,000# at 125 psig and 16,000# at 20 psig. 7500 sq. ft. surface condenser.
1—3750 KVA West. 3/60/2300/4000 V. 3600 RPM STRAIGHT CONDENSING nozzled for 375 psig 575° TT 11.75# water rate, 5500 sq. ft. surface condenser.
1—1250 KVA Al. Ch. 3/60/480 V. 3600 RPM, Terry II stage EXTRACTION turbine nozzled for 250 psig 550° TT, 40,000# extraction at 25 psig, 995 sq. ft. surface condenser.
1— 625 KVA El. Mchy. 3/60/480 V. 1200 RPM with direct connected exciter, gear driven, Worth. multi stage NON-CONDENSING turbine 4650 RPM now nozzled for 125 psig and 10 psig BP, suitable for pressures up to 300 psig. New 1949. Various other turbines.

BOILERS

1—90,000# Springfield sectional header cross drum 400# WP 750° TT new stoker fired.
1—50,000# Edgemoor bent tube 255# WP 400° TT Coxe chain grate stoker and economizer. New 1939.
2—502 HP nominal Heine water leg type 200# WP 480° TT Coxe chain grate stokers. New 1929.

DIESEL ENGINE UNITS

1—2800 HP Nordberg 6900 V. 60 cy.
1—2000 HP Fairbanks Morse 6900 V. 60 cy.
1—1600 HP Fair. Morse 2300/4150 V. 60 cy.
1— 600 HP Enterprise Dual Fuel 2400 V. 60 cy.
1— 250 HP Buckeye 240 V. 60 cy.

STEAM ENGINE UNITS—60 CY.

1—675 KVA Skinner Vertical Uniflow 480 V.
2—312 KVA Ames Vertical Uniflow 240 V.
1—250 KVA Ames Vertical Uniflow 480 V.
1—200 KVA Skinner Uniflow 230 V.
2—187 KVA Ames Vertical Uniflow 240/480 V.

MOTOR GENERATOR SETS—60 CY.

QU.	KW	MFR.	VOLTS-DC	A.C.	RPM
1	3000	G.E.	250	13200	514
1	2000	G.E.	600	4000	450
1	1500	G.E.	600	4150	600
2	1000	West.	660	4150	900
1	200	West.	275	2200	900
2	200	G.E.	250	4150	1200
2	150	G.E.	250	2300	1200
1	75	Ridgway	125	220	1200

SYNCHRONOUS MOTORS—60 CY.

QU.	HP	MFR.	VOLTAGE	RPM
1	3800	G.E.	6600	360
2	2500	A.C.	13200	514
2	700	West.	2300	200
1	600	G.E.	2300	240
1	300	G.E.	2300	600
1	300	West.	2300	900

FREQUENCY CHANGERS

QU.	KVA	MFR.	CYCLES	RPM
1	12500	G.E.	25/60	300
2	6875	West.	25/62½	375
1	3750	G.E.	25/60	300
1	3125	G.E.	25/60	300
1	2500	G.E.	25/62½	750
1	1875	A.C.	60/25	300
1	1700	West.	60/24	720

OIL CIRCUIT BREAKERS—Outdoor

1— 400 A. 37 KV G.E. FHKO-136-350
1— 400 A. 37 KV G.E. FHKO-236-500
4— 600 A. 15 KV G.E. FHKO-139-750
1— 600 A. 15 KV G.E. FHKO-136-250
1—1200 A. 15 KV G.E. FKO-139-350
1— 400 A. 7.5 KV G.E. FKO-227-50

1—6000 A. 600 V. G.E. AL-2-100 AIR

TRANSFORMERS

4— 3333 KVA West. 69300/66000—33000
6— 2000 KVA G.E. 66000/114000—2400
4— 500 KVA West. 69000—6900
3— 300 KVA G.E. 66000/33000—2300, 3 ph.
3— 200 KVA A.C. 45000—2400/7200
3— 150 KVA G.E. 44000—7200/12470 Y
3— 75 KVA West. 44000—7200/12470 Y
4— 5000 KVA G.E. 40935/70980 Y—14500
1—18750 KVA A.B.B. 34840—11000, 3 ph.
2— 5000 KVA West. 33000—26400, 3 ph.
4— 200 KVA A.C. 34500—6900/11950 Y
3— 150 KVA Wag. 33000—7200/12470 Y
3— 100 Kva West. 33000—240/480 NEW
3— 75 KVA Wag. 33000—7200/12470 Y
6— 2125 KVA G.E. 26400/13200—2300
4— 1500 KVA A.C. 25400/44000—6900/11800
4— 450 KVA A.C. 25410/44000—13280/23000
3— 1250 KVA G.E. 23000—2300/4000
3— 100 KVA G.E. 22000—7200/12470 Y
4— 500 KVA G.E. 19500—7200/12470 Y
1— 5000 KVA Mel. 13800—460, 3 Ph.
1— 450 KVA Penn. 13200—2400, 3 ph.
3— 200 KVA G.E. 13800—2300
1— 3750 KVA G.E. 11000—2300, 3 ph.
3— 250 KVA Pitts. 7200—220/440
3— 100 KVA G.E. 7200—240/480
3— 150 KVA Wag. 6900—2300
4— 100 KVA G.E. 6900/11900—2400
3— 37½ KVA G.E. 6900—230/460
3— 1500 KVA A.C. 2300/4000 Y—2300
2— 250 KVA West. 2300—460
3— 150 KVA West. 2400—230/115
1— 100 KVA G.E. 2300—575, 3 ph.
6— 50 KVA West. 2400—114/228 DRY TYPE

PARTIAL LIST — WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW, WOLTMAN & CO., INC.

50 Church Street — New York City 7, — WOrth 4-1470

4 B&W BOILERS

WATER TUBE—ASME CODE

From ATR Tug
Built 1943

15,000 lbs. steam/hr./unit—normal
18,000 lbs. steam/hr./unit—max.
Design Pressure—268 lbs./sq. in.
Temp., degree Fahrenheit
Total steam at drum outlet (saturated) . . . 409
Forced draft—turbine driven blowers
Boiler heating surface . . . 1508 sq. ft.
Fuel . . . oil or gas

FOR DETAILED INFORMATION

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THE BOSTON METALS CO.

313 E. Baltimore Street
Baltimore 2, Md.
Curtis 5050

REBUILT SYNC. MOTORS—60 Cycle

1—300 HP G.E. 720 RPM, 2200 V.
1—200 HP G.E. 900 RPM, 2200 V.
1—125 HP G.E. 1200 RPM, 220/440 V.
1—100 HP G.E. 720 RPM, 220/440 V.
1—100 HP West. 900 RPM, 2300 V.
1— 75 HP West. 720 RPM, 220/440 V.
2— 60 HP G.E. 900 RPM, 220/440 V.

REBUILT AC MOTORS—60 Cycle

1—200 HP West. SI.R., 490 RPM, 220/440 V.
1—200 HP G.E. SI.R., 870 RPM, 220/440 V.
1—125 HP West. Sq.C., 3530 RPM, 2300 V.
1— 50 HP G.E. SI.R., 900 RPM, 220/440 V.
1— 25 HP G.E. Sq.C., 1750 RPM, 220/440 V.
1— 20 HP West. TEFC-HT 1745 RPM, 220/440 V.
4— 10 HP West. TEFC, 1750 RPM, 220/440 V.
6— 5 HP Reliance Totally Enclosed, 720 RPM.

SHEPARD NILES HOISTS

1—3 ton AC — 2— 5 ton DC
2—5 ton AC — 1—10 ton AC

TIPPINS MACHINERY COMPANY

1001 WASHINGTON BLVD.
PITTSBURGH 6, PA.

ELECTRICAL EQUIPMENT

REBUILT N.I.S.A. STANDARDS

AC Motors—3 phase 60 cycle

HP	Speed	Make	Wdg.	Type & Disc.
200	7800	GE	SC	K-633S TEFC
200	600	GE	SR 2200 V.	IM-3 Brg.
175	600	Ideal	SR	AV-3 Brg.
150	720	Allis-Chal.	SR	AR-Hoist
125	3600	Elliott	SC 2200 V.	9NS02
125	600	GE	Syn.	T8-DC Exciter
100	1800	GE	SR	IM
100	725	Allis-Chal.	SR (25 cy.)	ARY-3 Brg.
100	900	GE	Syn. 2200 V.	T8-DC Exciter
75	900	AC	SC	AR-BB
75	600	GE	SR	IM
75	600	GE	SC 2200 V.	KT-535
60(2)	3600	GE & W	SC	K&CS 444SB
60(3)	1200	Allis-Chal.	SR	ARY-505 BB
60	900	AC	SC 2200 V.	ARZ-TEFC
50	1800	GE	SC	IK
50	1800	FM	SR	HV-BB
50	1200	GE	SR	MT-336
50	900	GE	SC	IK
50	720	CW	SC	SC
50	600	CW	SR	SR
40	3600	GE	SC	K-403s Exp. Pr.
40	1800	GE	SC	KT
40(2)	1200	Rel.&West.	SC	Pr 445-BB
40(2)	1200	FM	SR	HV-BB
40(2)	1200	AC&Rel	SC	TEFC-BB
40	900	West.	SR	CW
30(3)	1800	AC	SC/2200 V. /(1)220/440	ARZ TEFC
30	1200	AC	SC 2200 V.	ARZ TEFC
30	1200	CW	SC	SC-BB
25	1200	Howell	SC	KBB-405 TEFC

SPECIALS

3—150 KVA Transformers GE Type H Form KD 1/60 33000 V. pri-2300/6900/11950Y. 2—150 KW West. M-G Sets 275 V. DC 3/60/2300 AC. 2—56RZ Falk Motoreducers 125 RPM 50 HP Class II. Hundreds other motors and electrical Items in stock. Large stock new motors to 150 hp & Gearheads to 30 hp at rated discount—Freight allowed. SEND US YOUR INQUIRIES.

NATIONAL ELECTRIC SERVICE CO.

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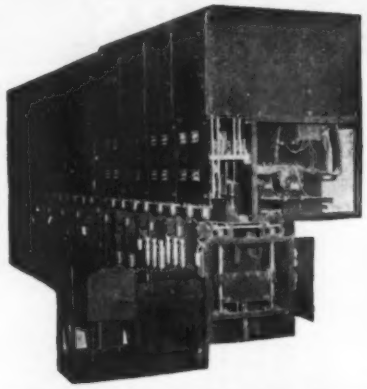

GENERAL ELECTRIC DRAWOUT OIL CIRCUIT BREAKERS

13—General Electric type MI-9 drawout type Metal Clad Switchgear, each unit containing one FK-143R, 1200 ampere, 7500 volt, 3 pole, 50,000 KVA oil blast oil circuit breaker, solenoid operated, 125 volt DC, complete with control switch, indicating lamps, current and potential transformers.

The above is one complete switchboard but can be divided to suit your needs.

OUTDOOR OIL CIRCUIT BREAKERS
(without oil)

Qu.	Make	Type	Volt	Amp.	Control	Int. Cap.
2	G. E.	FHKO-236-2452-BF73	73,000	600	Motor	500,000
1	G. E.	FHKO-136-2046	73,000	400	Solenoid	350,000
2	G. E.	FKO-136-2046-BS	50,000	400	Solenoid	280,000
1	Condit	FO-40-37-C	37,000	400	Solenoid	750,000
1	G. E.	FHKO-236-1640-BS	37,000	400	Solenoid	500,000
1	G. E.	FHKO-136-2046	37,000	400	Solenoid	500,000
1	G. E.	FKO-136-1026-AS	25,000	400	Manual	125,000
3	Condit	OI	23,000	400	Manual	60,000
1	G. E.	FKO-139-24-AS	15,000	600	Solenoid	350,000
1	G. E.	FHKO-136-1328-BS	15,000	600	Solenoid	250,000
1	G. E.	FKO-139-24-AS	15,000	1200	Solenoid	350,000

POLE LINE SWITCHES

Qu.	Make	Type		Volt	Amp.	Control	Int. Cap.
17	Condit	PK-5	3 pole	4,500	200	Non-Auto.	10,000
10	El. Spec.		3 pole	7,500	200	Non-Auto.	10,000
4	G. E.	FKO-37	3 pole	15,000	400	Solenoid	40,000
1	G. E.	FKO-37	3 pole	37,000	400	Solenoid	40,000

OUTDOOR CURRENT TRANSFORMERS

Qu.	Make	Type	Volt	Ratio
2	G. E.	K-202	25,000	15/30/5
3	Westg.	OA	34,000	15/30/5
2	Westg.	OB	45,000	15/30/5
2	Westg.	OB	47,000	40/80/5
6	Westg.	D-22	23,000	50/100/5
3	G. E.	K-61	37,000	150/300/5
3	Westg.	OA	34,500	200/400/5
3	A-C	CW	34,500	300/5/5

NEW AND RECONDITIONED SWITCHGEAR

JOSEPH P. MANYPENNY CO.

PHONE DE 6-3300

1667 MEADOW ST. **PHILADELPHIA 24, PA.**

PUMPS—COMPRESSORS—BLOWERS

1—2000 GPM 350' Pump with 240 HP Turbine
1—750 GPM 231' Pump with 75 HP 3 ph. motor
2—A.B. 20 H.P. Turbo-Blowers 500 CFM 4 PSI
2—600 GPM 360' Pumps with 72 HP Turbines
1—200 GPM 556' Pump with 50 HP 3 ph. motor
1—200 GPM 556' Pump with 50 HP Turbine
1—1100 GPM 229' Al.-Ch. Cent. Pump
4—2000-5000 GPM 32'-65', 10" & 12" Pumps
1—1000 GPM 280' all-bronze Cent. Pump
1—Kinney unused 6" Rotary Pump
3—Blackmer 6" Rotary Pumps 500 GPM
3—750 & 1000 GPM Knowles Steam Fire Pumps
1—Beach-Russ Vacuum Pump, 110 C.F.M.
1—1—6" x 10" & 1—7" x 10" Triplex Pumps
1—3" x 8" Galland Hydraulic Triplex Pump
1—9" x 10" Gardner Duplex Pump 300 GPM
1—12" x 14" Duplex Air Compressor 850 CFM
1—12" x 10" I-R Air Compressor 355 CFM
2—12" x 9" Worth. Comp. 375 CFM. Vac. & Press.
1—4-stage Norwalk Compressor 28 CFM 5000 PSI
1—Sturt. 60 H.P. Turbo-Blower 7000 CFM 20 oz.
1—G.E. 60 H.P. 220 volt Compensator
1—GE 2-stage Turbo Blower 3000 CFM 10 PSI
1—Spencer 30 H.P. Tur. Blower 4000 CFM 16 oz.
1—60 H.P. DC 230 v. 1150 RPM comp. C-W Motor
1—50 H.P. DC 230 v. 1750 RPM ball-bear Motor
10—Nash Vacuum Pumps and Vac.-Heating Units
4—Roots Blowers, No. 710 AF
72—Exhaust Blowers, Fans, Unit Heaters.
1—C-H 50-60 HP 220 V. DC Mag. Starter
HUNDREDS OF OTHER ITEMS—ALL SIZES—ALL MAKES

SUPERIOR EQUIPMENT CO.
136 GRAND ST., N.Y.C. 13 CA 6-6983

FOR SALE

MODERN 1000 KW Turbo-Generator

In excellent Condition

Non-Condensing, Steel case 80# back pressure .8 P.F., 3 phase, 60 cycle, 4150/2300 volts, alternating current, complete with accessories, switchboard, oil circuit breaker and direct connected exciter. Only operated alternately for six years. Ideal for Chemical, Rubber, Petroleum. Textile, Pulp and Paper, and Sugar Refining Industries.

NEWMAN & COMPANY, INC.
6101 Tacony St. Philadelphia 24, Pa.

SLIP RING MOTORS—3 Ph., 60 Cy.

40	**Tl. Chal.	440	B. Brg.		900
50	**C.W.	220	SR40Y		1745
50	West.	220	CW		1175
500	G.E.	2300	Rebuilt	17B	900
*600	West.	440	CW	432D15	1800

SYNCHRONOUS MOTORS—3 Ph., 60 Cy. With Direct Connected Exciters

4	75	**Burke	220/440			***1800
2	125	**El. Mach.	4800			900
10	135	***G.E.	4000	TS	96Z	1200
1	*200	**El. Mach.	208			1200
1	*300	**El. Mach.	208			1200

WORTHINGTON CENTRIFUGAL PUMPS

2—700 GPM @ 290' w/75 HP C.W. 3/60/203V/1755 RPM
1—350 GPM @ 200' w/50 HP C.W. 3/60/208V/1745 RPM
1—1000 GPM @ 231' w/100 HP G.E. 3/60/220V/1800 RPM

*NEW—**BALL BEARING—***SEP. EXCITER

ALBERT HELLER CO.
210 Snediker Ave., B'klyn, 7, N.Y. HYacinth 5-0800

MODERN BOILER

60,000# Steam/hr 275# pressure
2 drum, Water Walls, New 1936

STEPHEN A. DOUGLASS CO.
630 Fort Washington Ave., N. Y. 33, N. Y.

AVAILABLE 450 KVA 13200 to 115/230 volt SUBSTATION 700 & 450 HP 80 rpm 4160 volt UNUSED SYN. motor Ball mill torque
3—600 Amp. 15 kv G.E. metalclad switchgear units.
1—37½ KVA 240/480 V. Caterpillar Diesel Gen. set.
WANTED 2—1000 KW 250 volt DC 175 lb. Con. turbines.
3—300 KW Rectifiers 4160 or 480 AC to 250 V. DC.

H. BLANE JOHNSON & ASSOCIATES
53 W. JACKSON BLVD., CHICAGO 4, ILL.

COMPLETE DIESEL PLANT

3—Fairbanks Morse units. 805 HP—556 KW; 690 HP—473 KW; 300 HP—200 KW. Model 33-E-14. 3/60/2400 volts. New 1940. Will sell all or part. With auxiliaries. Condition excellent.

MISSISSIPPI VALLEY EQUIPMENT CO.
507 Locust St. St. Louis 1, Mo.

WORLD'S LARGEST INVENTORY

NEW AND GUARANTEED REBUILT EQUIPMENT

MOTORS TRANSFORMERS GENERATORS DIESELS

WRITE, WIRE OR PHONE

ELECTRIC EQUIPMENT CO.
L. D. (Long Distance) 65
ROCHESTER 1, NEW YORK

Explosion Proof Motor Headquarters

2—500 KW TURBO GENERATORS

DC, 240/120 Volts, 1200 RPM, geared to Westinghouse 500 KW Geared Turbines, 200 to 300# steam pressure, condensing, modern.

SUNDFELT EQUIPMENT COMPANY, INC.
220 Hudson St. Seattle 4, Wash.
LAnder 9311

FOR SALE

200 KW G. M. DIESEL GENERATORS
Engine—G.M.C., 8-268-A, 8 cyl., 2 cy., 1200 R.P.M. Serial No. 12550, direct connected. Generator—Westinghouse, 250 KVA, 80% P. F., 3 ph., 60 cy., 480 volt with direct connected 40 KW 125 volt D.C. generator and exciter.

P. A. HENAULT
25167 Grand River Ave., Detroit 19, Mich.

SWITCHGEAR • TURBO-GENERATORS • TRANSFORMERS

10,000 KVA TRANSFORMER BANK — **3—3333 KVA 1 Ph. 60 Cy.**
66000 to 33000 and 13200 volts Westinghouse

1800 KVA 3 PHASE TRANSFORMER — **6600 to 440 volts 60 Cy.**

OTHER TRANSFORMERS
1 PH. 60 CY.

2—1000 KVA 13800/2300 V.
3— 200 KVA 33000-2300/4600 V.
7— 100 KVA 33000—2300/4600 V.
3— 75 KVA 2400-240/480 V.
40— 10 KVA 2400-120/240 V.

DIESEL GENERATOR

250 KW Superior YLO 350 HP
400 RPM 3/60/2200-440 or 220

OUTDOOR
OIL CIRCUIT BREAKERS

1— 600 A. 110 KV GE FK0136
1— 400 A. 73 KV West. G-1
3— 400 A. 37 KV GE FK0136
1— 400 A. 37 KV West. 0221
1—1200 A. 15 KV GE FHK0236
1— 600 A. 15 KV West. 0221
1— 600 A. 15 KV Condit 0-1

OUTDOOR
POTENTIAL TRANSFORMERS

13—33000/110 V. 200 V—A GE E116
3—33000/110 V. Westinghouse

INDOOR
OIL CIRCUIT BREAKERS

1—2000 A. 15 KV 500 MKVA West. CO-11
9—1200 A. 15 KV 500 MKVA West. CO-11
1—1200 A. 15 KV 150 MKVA West. B20B
1— 800 A. 15 KV 130 MKVA West. B20
12— 400 A. 15 KV 130 MKVA West. B-20
1—2000 A. 4500 V. GE K-34

Galvanized Steel Substation Structures — Air Break Gang Operated Switches 73 KV, 37 KV & 15 KV — Outdoor & Indoor Disconnects

TURBO-GENERATORS IN STOCK

1—6250 kva 5000 kw 3600 rpm Allis-Chalmers 200 lbs. 100° SH Condensing. Will operate 275 lbs. 615° TT without change. Generator 3/60/11500—can be changed to 2400/4160 V. Complete auxiliaries—can be operated for inspection. Checked by factory engineer in Sept. 1951—no repairs required.
1—1567 kva 1250 kw 3600 rpm Allis-Chalmers 150 lbs. condensing. Will operate 200 lbs. 450° TT without change. Generator 3/60/2300. Complete auxiliaries.
1—1250 kva 1000 kw 3600 rpm Westinghoues 185 lbs. 100° SH condensing 3/60/2300. Completely reworked, generator has new winding. Complete auxiliaries.
1—937 kva 750 kw 3600 rpm General Electric 150 lbs. condensing. Generator 3/60/2300.
1—625 kva 500 kw DeLaval geared 5000/900 rpm 150 lbs. condensing. Generator 3/60/2300. Can operate 275 kw 10 lbs. BP without change.
1—187½ kva 150 kw Westinghouse geared 7200/900 rpm 150 lbs. 100° SH non-condensing. Generator 3/60/240.
1—125 kva 100 kw West. geared 7200/900 rpm 150 lbs. non-condensing 3/60/240.
1—1500 kw 3600 rpm 3/60/2300 Gen. Elec. 140 lbs. non-condensing.
1—1000 kw 3600 rpm 3/60/2300 Gen. Elec. 140 lbs. non-condensing.
1—500 kw 3600 rpm GE non-condensing 175 lbs. throttle 3/60/2400.

TAMPA ARMATURE WORKS, INC.
"Industry's Friend"
401 S. MORGAN ST. PHONE 2-1966 TAMPA, FLORIDA

BOILERS

10 to 1000 H. P.
NEW-USED
RECONDITIONED
Steam, Gas and Electric Power Equipment
J. PARKER THOMPSON CO., INC.
507 FIFTH AVE., NEW YORK CITY
MURRAY HILL 7-6547-8-9

STEAM TURBINE FOR SALE

825 K. W., 240 Volt Allis-Chalmers Turbine Unit operate at 300 pounds gage—620° F. Total Temperature—Condensing and Extraction. May be seen in operation through January, 1953.

FS6276, POWER
330 W. 42 ST., NEW YORK 36, N. Y.

1—125 KW 400 RPM 187½ HP Buckeye Diesel Generator Set with all accessories.
1—225 HP Buckeye Diesel 400 RPM Belted Unit.

ROBERT L. NEISWANDER
1007 S. Ocean Dr., Hollywood, Fla.
Phone 9074

FOR SALE
18 NEW TURBINES
4 horizontal, 14 vertical, Westinghouse

Driving forced draft blowers—capacities ranging from 39000 to 56000 CFM and 16" to 24" pressure. Steam pressures 360 to 575#, back pressure 10#.

Will sell turbines separately if desired. *Price reasonable.*

Also—1—250 KW GE turbo generator unit, 3 phase, 60 cycle, 440 volt. Used one year.

G. M. DeROSE
2457 WOODWARD AVE.
408 DONOVAN BLDG.
DETROIT 1, MICH.

SPECIAL TRANSFORMERS—YOUR SPECIFICATIONS

NEW TRANSFORMERS
OIL COOLED
AIR COOLED
PHASE CHANGERS

ARROW TRANSFORMER CO., INC.
1932 E. Westmoreland St., Philadelphia 34, Pa.
GArfield 5-0433

USED TRANSFORMERS
REWOUND
REBUILT
RECONDITIONED

1250 HP & 725 HP WESTINGHOUSE

REDUCED VOLTAGE, AUTOMATIC, 2300 VOLTS, STARTING EQUIPMENT.
3 PHASE 60 CYCLES

EMPIRE ELECTRIC CO., INC. **87 JAY STREET, BROOKLYN 1, N. Y.**

LAND'S 44th YEAR
MOTORS & GENERATORS, etc.
1 YEAR GUARANTEE

GENERATORS—250 V. D.C. Motor Driven

KW	Make	Type	Speed
1000	Al. Ch.		720
250	Cr. Wh.	CCD	1200
200	West (2)	SK-18	1200
150	West.	SK	900
125	G. E. (2)	MPC	1200
125	El. Dy.	20L	1750
100	Delco (4)		1150
75	Cr. Wh.	51H	1150
50	Cr. Wh.	HH	1150
40	West.	SK	1750
35	G. E.	RC	1750
35	Al. Ch. (4)	3 wire	1750
25	G. E.	CS	1200
15	Start		1750
7½	West.	SK-43	1750
5	West.	SK-284	1750
5	Rel.	T-23T	1750
3	Rel.	T-14T	1740

GENERATORS—Low Voltage D.C.

Amp.	Make	Voltage
10,000	H-V-W	6
10,000	J-L	10
6000	El. Prod.	18/36
5000	H-V-W	6/12
4000	North.	7½
3000	Chandey.	12
2500	Chandey.	6/12
1500	H. V. W.	6/12
750	H-V-W-	6/12
1000	G.E.	15
1000	G. E.	25
1000	West.	24
100	Diehl	32
200	West.	35
200	Burke	35
125	Diehl	40
500	G. E.	32
1500	Century	45
3200	G. E.	50
325	West.	50
1000	G. E.	75

230 V. D.C. MOTORS

H.P.	Make	Type	Speed
250/200	Rel.	2600T	400/800
150	West.	SK	1150
150	West.	Sk	850
125	Rel.	T	600
125/50	E. D.	20-SL	1750 1315
100	West. (4)	SK	1150
100	West. (6)	Sk	850
100	Rel.	651-T	850
100	G. E.	RC	600
100	Rel	1060T	500
100	A-C		1150
100	FM	TRC-38	725
110/55	G. E.	DMC	800/400
90/45	G. E. (2)	RF-17	950/475
75	G. E.	CD-155	1150
75	West. (6)	SK	1150
75	G. E.	RC	1600
75	Rel.	461-T	850
75	West. (2)	SK	850
75	West.	SK	475
75	Cr. Wh.	CMC-125H	375/950
60	West.	SK	850
60	West.	SK-160	680
60	West.	SK	250/1000
50	Cr. Wh.	CMC-FH	1750
50	G. E.	CD-93	3600
50	West.	SK-160	565
50	G. E.	RF-17	250/1000
40	G. E. (3)	CD-105	850
40	Cr. Wh.	FH	1750
40	West (5)	SK	775
35	E-D	258	350/1050
35	West.	SK	250/1050
35	West	SK	1150

SLIPRING MOTORS

H.P.	Make	Type	Speed
600	Cr. Wh.	131-AQ	307
500	G. E. (2)	IM	450
200	G. E.	MT-559Y	1175
150	G. E.	IM	870
125	West.	CW	1750
125	G. E.	IM	580
100	G. E.	MT347	1150
100	G. E.	IM	690

SQUIRREL CAGE MOTORS

H.P.	Make	Type	Speed
250	GE(TENV)	K-6335	1750
200	Wagner	RP2-26Z	1800
200	West.		1750
200	A. Ch	AR	865
200	G. E.	XP-6335	880
150	West.	CS	1175
150	G. E.	IK	580
125	A. Ch. (2)	53R	3500
125	A. Ch. (5)	AR	1890
125	Century		3500
125	A. Ch.		690
100	West.	CS6078	3540
100	West.	CS	870

Partial Listing Only!

Please Send Us Your Inquiries

L. J. LAND, INC.

Established 1910

156 GRAND STREET, NEW YORK 13, N. Y.

CAnal 6-6976

SLIP RING MOTORS

220 or 440 volt, 60 cycle, 3 phase, slip ring Motors Rebuilt

H.P.	Make	Type	Speed	Description
400	G.E.	I-M	1200	S.B.
300	G.E.	I-M	1200	S.B.
200	G.E.	I-M	1200	S.B.
150	G.E.	I-M	1200	S.B.
150	G.E.	I-M	1800	S.B.
100	G.E.	MT-300	1800	S.B.
100	G.E.	I-M	900	S.B.
100	G.E.	I-M	720	S.B.
75	G.E.	MT-343	1200	S.B.
75	G.E.	I-M	900	S.B.
75	West.	CW	720	S.B.
75	G.E.	I-M	720	S.B.
60	G.E.	MT-333	1800	S.B.
40	G.E.	I-M	1800	S.B.

BRAND NEW SQUIRREL CAGE MOTORS

Totally enclosed, fan cooled, explosion proof, open 220 or 440 Volt, 60 Cycle, 3 Phase

H.P.	Make	Type	Speed	Description
150	G.E.	K-6326	3600	TEFCBB
150	G.E.	K-6326	1800	TEFCBB
125	G.E.	K-6326	1200	TEFCBB
100	West.	CS-6075	1800	TEFCBB
100	West.	CS-504	1800	B. B. open
75	West.	CS-504	3600	TEFCBBXP
75	A.C.	ARZ	1800	TEFCBBused
75	West.	CS-504	1800	TEFCBBXP
75	West.	CS-445	1800	B. B. open
75	F.M.	QS-445	1800	B. B. open
75	West.	CS-505	1200	TEFCBBXP
60	West.	K-5945	1800	TEFCBBXP
60	G.E.	OG-44	1800	TEFCBBXP
60	L.A.	QS-444	1800	B. B. open
60	F.M.	FB-404	3600	B. B. open
50	Master	K-445	1800	TEFCBBXP
50	G.E.	K-405	1800	TEFCBB
50	G.E.	CS-445	1200	S. B. drip
50	West.	K-505	900	S. B. open
50	G.E.	AR-444	3600	TEFCBBXP
40	A.C.	KF-3655	3600	TEFCBBXP
40	G.E.	CS-405	1800	B. B. Splash
40	West.	K-405	1800	TEFCBB
40	L.A.	404	1800	TEFCBBXP
40	G.E.	CS-5045	1800	B. B. open

REBUILT SQUIRREL CAGE MOTORS

220 or 440 Volt, 60 Cycle, 3 Phase, Open

H.P.	Make	Type	Speed	Description
200	Wagner	RP-2-26	1800	S. B.
200	Wagner		1200	S. B.
200	G.E.	K-564	900	B. B. new
150	West.	CS	1800	S. B.
150	G.E.	I-K	1200	S. B.
150	G.E.	I-K	720	S. B.
100	West.	CS	1800	S. B.
100	G.E.	I-K	1800	S. B.
100	G.E.	I-K	1200	
100	G.E.	KT-347	1200	S. B.
100	West.	M5	1200	S. B.
100	West.	CS	900	S. B.
100	G.E.	I-K	720	S. B.
75	West.	CS	1800	S. B.
75	West.	CS	1200	S. B.
75	G.E.	I-K	900	
75	G.E.	KT-343	1200	S. B.
75	West.	CS-WL-607	1200	S. B. B.
75	G.E.	KT-552	900	S. B.
75	G.E.	KT-352	900	S. B.
75	G.E.	KT-346	720	S. B.
60	G.E.	KT-333	1800	S. B.
60	G.E.	I-K	1200	S. B.
60	West.	CS	1200	S. B.
60	G.E.	KT-346	900	S. B.
60	G.E.	I-K	900	S. B.
50	G.E.	I-K	1800	S. B.
50	Cr. Wh.	25R	1800	S. B.
50	G.E.	KT-327	1800	S. B.
50	G.E.	KT-336	1200	S. B.
50	West.	CS	1200	S. B.

We have in stock explosive proof motors 220/440/60/3 ranging in HP from ½ to 50 HP 900 to 1800 RPM. We also carry in stock a large quantity of used electric motors from 1 HP up to 500 HP., generators, transformers and control equipment. Upon receipt of your inquiries, we shall be glad to quote.

POWER
EQUIPMENT COMPANY

8 CAIRN ST., ROCHESTER 2, N. Y.

P. O. BOX 534 — Tel: Genesee 5629

1—400 H.P. Keeler C.P. Integral Type Watertube Boiler with complete Todd Oil Burner installation. Design Pressure 160#. Built 1940.

2—500 HP Cleaver-Brooks, 200# pressure. No. 6 oil, complete with pumps and receiver. All trim.

2—460 H.P. Springfield Sectional Header, Cross Drum, 250# w.p. water walls, 1946.

1—600 H.P. B&W Sec. Headers, Long. Drum Boilers, 225# w.p., ASME, built 1922.

1—300 H.P. Titusville Scotch Marine, 125# w.p. Fully automatic, No. 6 oil, Todd Rotary Burner.

1—490 HP Walsh-Weidner sec. Hdr. Cross Drum. 450 lbs. Superheater, etc.

1—250 H.P. Johnson Scotch Marine Boiler, 150# W.P., New in 1950. Fully automatic. No. 6 oil. With all auxiliaries.

1—200 H.P. Bigelow Scotch Marine, 150# w.p. Fully automatic, Ray Burner, No. 6 oil, 1940.

2—854 HP Springfield Sec. Hdr. 225 lbs. Superheaters, etc.

2—250 HP Erie City—3 Drum lowhead. 200 lbs. —a complete Plant 1946. 200# w.p. fully automatic mechanical Peabody burning equipment. 1—Pratt-Daniels Stacks, pumps and heaters.

1—310 HP Keeler "CP" Self-Contained. 160 lbs. With or without STOKERS. Complete Plant.

1—Babcock & Wilcox FF-15 Self-contained. 160 lbs. Complete Plant—16,000 lb. each.

2—750 HP B&W Sterling, 1925, 225# w.p.

1—125 H.P. Erie City Economic, 125# pressure. Complete with stack and trim. 1946.

1—125 H.P. Cleaver-Brooks, 125# w.p., No. 5 oil, 1946, pump, receiver and breeching.

1—80 H.P. Erie City Economic, 125# w.p. Ray Oil Burner, fully automatic, return system and stack. No. 6 oil, 1940.

1—30 H.P. Titusville, 125# w.p. 1947. No. 2 oil.

1—25 H.P. Bessler, 450# w.p. No. 2 oil, 1944.

1—15 H.P. Cleaver Brooks Package, 125# w.p. No. 2 oil, 1946.

1—10 HP Titusville Wee Scot, 125# w.p. Light oil, 1946.

Miscellaneous Scotch Marine Boilers, 75 to 150 H.P. available.

A Number of Self-Contained & Economic Units, 50-150 H.P., 100-200 Lbs. Pressure.

2—Detroit Roto-Spreader Stokers for 300 H.P. Boilers, nominal rating.

Combustion Engrg., Spreader Stoker complete with fan & Hogan Controls-Stoker. Designed for 600 H.P. boiler at 200% of rating, or 1200 H.P.

1—750 K.W. and 1—500 K.W. DC 240 V Generators dir. conn. to 2—Westinghouse non-cond. Turbines—3600 r.p.m. reduced to 900 r.p.m. on generators. Includes switchboards.

WARNER J. SHERB, INC.

342 Madison Avenue, New York, N.Y.

Telephone MUrray Hill 2-9098

SLIP RING MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Speed
500 (2)	2200	G.E.	900
500	2285	G.E.	450
450	440/220	Whse.	514
350	2200/440	G.E.	450
300	2200	G.E.	360
300	440	Whse.	3600
250	4000/2300	G.E.	450
250	440/220	Whse.	600
250	550/440	G.E.	1200
250	440	G.E.	600
200	440/220	Whse.	514
200	440	G.E.	450
188	4000/2300	G.E.	1800
150	2200/440	G.E.	600
150	440/220	G.E.	450
145	4000/2300	G.E.	1800
125	2200/440	G.E.	600
125	550/440	G.E.	1200
100	440/220	G.E.	600
100	440/220	G.E.	900

SYNCHRONOUS MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Type	RPM
400	2200/440	G.E.	ATI	720
300	2300/460	G.E.	TS	720
300	440/220	G.E.	ATI	600
250	2200/440	G.E.	TS	1200
250	440/220	Whse.	HR	257
250	440/220	G.E.	ATI	600
240	2300/440	G E	ATI	720
200	4150/2300	Whse.	G	1800
120	440/220	G.E.	ATI	900
110	440/220	G.E.	TS	257
100	440/220	Whse.	G	1800
75	2200/440	Whse.	GE	600

PLATING UNIT

1—5,000 amp., 4/6 volt (or 2,500 amps., 8/12 volts) A.P. Munning, double commutator dir. conn. to 50 hp. G.E. sq. cage motor.

Engine Generator Set

1—150 kw. 1200 rpm, 480/240 V., 3 ph., 60 cy., Whse., conn. to 240 hp. 1200 rpm, Sterling gasoline engine, practically new.

CIRCUIT BREAKERS

2—2000 amp., GG E., 3 pole, 600 v., air
2—1600 amp., ITE, 3 pole, 600 v., air
1—400 amp., 7500 V., G.E., outdoor, new

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
650	2200	G.E.	PT	3600
500	2200/4000	Elliot	SC	1800
350	2200	G.E.	KT	1200
300	2200	G.E.	PT	3600
250	440	G.E.	JK	720
250	2200	Al.-Chal.	AR	1800
225 (2)	2200/440	G.E.	KT	1200
200	2200/440	G.E.	K	1200
200	440	G.E.	JK	720
200	410	G.E.	IK	514
200	440/220	G.E.	KT	1800
150	220	Whse.	CS	1200
150	440	Multi sp.	KT	1800/600
150	440/220	G.E.	IK	450
150	440/220	G.E.	KT	720
150	440/220	Howell	B. Brg.	1800
150 vert.	440/220	G.E.	KTP	1200
150	440/2200	G.E.	IK	514
150	2200/440	G.E.	KT	600
100	2200/440	G.E.	K	1200
100	2200/550	Whse.	CS	900

A. C. GENERATORS

1—320 kva, 660 rpm, 2300/440/220 V., G.E.
1—875 kva, 1200 rpm, 440 V., G.E.
1—250 kva, 720 rpm, 2300/440 v., G.E.
1—225 kva, 600 rpm, 220/440 v., G.E.
1—187 kva, 1200 rpm, 440 V., Whse.
1—150 kva, 900 rpm, 480/240 v., G.E.

D. C. MOTORS

HP	Volts	Make	Type	Speed
250	230 (2 new)	Cr. Wh.	CMC	1800
225	230	G.E.	CD	600
150	230	Whse.	SK	850
120	230	Whse.	SK	350/1050
100	230	El. Dyn.	30-3	475/1250
100	230	Cr. Wh.	CMC	625
100	230	G.E.	CD	1750
75	230	G.E.	CD	1150
75	230	Whse.	SK	850
50	230	Rel.	T	400/1200

MOTOR GENERATOR SETS

KW	Make	Input V., AC	Motor Type	Output V., DC
250	Whse.	2200	Syn.	250
175	G.E.	220/440	Syn.	250
150	Whse.	440	sq.ca.	250
100	Al. Ch.	2200/440	sq.ca.	240/120
100	Cr.Wh.	440	sq.ca.	250
75	G.E.	2200/440	syn.	125
65	G.E.	2200/440	sq-ca.	250
65	G.E.	2200/440	sq.ca.	125
60	G.E.	440/220	sq.ca.	250/125
45	G.E.	440/220	sq.ca.	250
40	G.E.	440/220	sq.ca.	250/125

TRANSFORMERS 60 CY.

1—1500 kva, Al. Chal., 11000—480 volts, 3 phase
1—1000 kva, G.E., 1200—480 V., 3 phase
1—300 kva, Al. Chal. 4800/4160—240/120 V., 3 phase
3—250 kva, G.E., 4000—230/460 V.
1—150 kva, Whse., SK, 1000 125/215 v., 3 ph.
3—150 kva, Al. Chal., 2400-240/120 V.
3—100 kva, Whse., 2400-240/480 V.
6—100 kva, Whse., 2400—120/240 V.
5—100 kva, G.E., 4150—120/240 V.
2—100 kva, Whse., 2400—120/55 V.
3—75 kva, Whse., 2400—240/480 V.
3—75 kva, Moloney, 4150—240 V.
6—50 kva., G.E., 2400—120/240 V.
11—50 kva, Whse., 2300-110/220 V., dry

STEPHEN HALL & CO.

HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

AIR COMPRESSOR

1—Ingeroll-Rand size 14½ x 14½ x 10 Class XRE single stage, direct conn. air compressor, 35# press. with 5 step clearance control. 150 H.P., 360 R.P.M., 440 volt, 3 phase, 60 cyc., 80% power factor, 50°C. engine type synch. motor, comp. with all auxiliary equipment. New 1950.

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10 to 5000 HP — 10 to 900 PSI

Diesel Engine — Steam Turbine

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Curtis 4434 DuPont 7-3386

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DIESEL ENGINES

1—300 HP Busch Sulzer—312 KVA Generator
1—300 HP Vern Severin—with 250 KVA Generator
1—480 HP Fairbanks with 400 KVA Generator
3—360 HP Fairbanks with 300 KVA Generator
3—240 HP Fairbanks with 200 KVA Generator
1—180 HP Fairbanks with 150 KVA Generator
3—120 HP Fairbanks with 90 KVA Generator
1—240 KVA Ames Unaflo Steam Generating unit

All of the above at Bargain Prices

A. C. ASKEW
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TULSA 8, OKLA.

GENERATORS, TRANSFORMERS, MOTORS AND LATHES

For immediate delivery, subject to prior sale
Bertram 32" swing 17' center Q.C. 1951
Pittsburgh 49" swing 11' center SQC, rebuilt
London 38" swing 20' center

ALL 60 CYCLE GENERATORS

2 only—1700 kva 360 rpm 2400 volt at 0% P.F.
1 " 250 kva 600 rpm 600 volt
2 " 725 kva 480 volt, 600 rpm
2 " 750 kva 480 volt, 720 rpm
2 " 1475 kva 600 rpm 2200
1 " 1100 kva 514 rpm 2200
2 " 750 kva 480 volt, 750 rpm
1 " 350 kva 750 rpm 480 volt
1 " 750 kva 750 rpm 480 volt
1 " 200 kw 550 volt 600 rpm
1 " 312 kva 2300 volt 720 rpm
1 " 1000 kw 200 rpm 2200 volt
3 " 2000 kw 180 rpm 2200 volt

ELECTRIC MOTORS

3500 hp squirrel cage, 120 rpm 2300 volts
2500 hp slip ring, 6600 volts
1500 kva synchronous 900 rpm
800 hp slip ring
300 hp slip ring, 785 rpm 2300 volt
250 hp 3600 rpm 440 volt, drip proof
Hydro sets 60 and 25 cycle
5—2000 kw 36 ft. head
2— 750 kva 18 ft. head
1— 200 kw 500 ft. head
2—1000 kva 500 ft. head
2—1400 kva 26 ft. head
2—3000 kw frequency changers

WATER FEED AND FUEL PUMPS

10 x 8 Bryan Jackson centrifugal
8 x 6 Kingsford Smith centrifugal
B & W Centrifugal (4" x 12", 5414 gpm, 270 ft. head, 500 hp 2200 volt motors built 1938 used.

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19500 kva 115000/66650/40000, will rewind to 13800/3/60.
12000 kva G.E. 115000/13800/3/60
1000 kva G.E. 12000/2400/4160Y/3 substations, complete
5000 kva G.E. 66000 or 33000/13200
100 kva 33000/22000/2200/1.
150 kva 26000/13200/2300/575/1

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6000 kva Diesel Generator built 1938
1500 kva Hyde-Electric Generator unused
750 kva Skinner Uniflow 127/220 volt, condition comparable to new, 150 psi.

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5—714 HP Combustion Engineering WATER TUBE BOILERS, with Ebasco Superheaters, Sturtevant High Pressure Economizers, Green Chain Grate Stokers, Hagan Combustion Controls, Copes Feed Water Regulators, Clarage Forced Draft Fans, Sturtevant Induced Draft Fans, Smoke Stacks. Good for 250# pressure by Hartford.
1—705 HP Stirling 4 drum Boiler with B&W Superheater, Green Chain Grate Stoker, Sturtevant Economizers, Sturtevant Induced Draft Fan, with Smoke Stack. Good for 250# pressure by Hartford.
2—8000 HP Webster Water Heaters.
1—McCaslin Pivoted Bucket Conveyor System for handling coal and ashes. Approximately 360' long.
6—Steel Coal Bunkers, 80 tons each.
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1—4"x6" Dayton-Dowd Centrifugal Pump direct connected to 125 HP General Electric-Curtis Steam turbine.
1—100 KW General Electric 125 Volt DC Generator direct connected to a General Electric-Curtis Steam Turbine, 2-stage with reduction gear, Type SO, 3600 to 1200 RPM.
1—Type 1A-60 Wheeler Turbo Air Pump direct connected to 75 HP General Electric-Curtis 2-Stage Steam Turbine, 1750 RPM.
1—6" Wheeler Centrifugal Condensate Pump direct connected to a 20 HP General Electric-Curtis 2-Stage Steam Turbine, 1800 RPM.
1—Combination Circulating Pump and Condensate Pump driven by 190 HP General Electric single Stage Steam Turbine through a Westinghouse Reduction Gear, 3500 to 700 RPM.
1—7" 2-stage LeCourtney Centrifugal Pump, 200 GPM 650' Head at 3700 RPM direct connected to 53 HP Westinghouse Steam Turbine.
1—3000 KVA General Electric Synchronous Converter, Type HCC, 6 phase, 25 cycle, 250 RPM, 600 Volts DC with 1—3150 KVA General Electric Transformer, 3 phase, 25 cycle, 6600/13200-445 Volts with starting panel and all instruments.
1—1000 KVA General Electric Synchronous Converter, Type HCC, 6 phase, 25 cycle, 750 RPM, 600 Volts DC with 1-1050 KVA General Electric Transformer, 3 phase, 25 cycle, 13200/445 volts with starting panel and instruments.
1—500 KW Westinghouse Synchronous Converter, 6 phase, 60 cycle, 1200 RPM, 600 Volts DC with starting panel and instruments.
1—4000 KVA Westinghouse Transformer, 3 phase, 25 cycle, 13200/6600 volts.
7—700 KVA Westinghouse Transformers, single phase, 25 cycle, 7620/6600 volts to 13200 volts.
1—Kennecott Pressure Type Industrial Water Filter.
1—50-Ton Electric Traveling Crane—55'5½" Span.

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BETTER FOR MANY AIR HANDLING APPLICATIONS

NEW! CLARAGE DEVELOPMENT

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MOTOR DRIVEN ASSEMBLIES—NO EXPENSIVE FOUNDATIONS REQUIRED

Clarage V-belt Ready Units come in 18 sizes — capacities to 12,000 c.f.m. . . . within their range, the ECONOMY ANSWER to almost any INDOOR or OUTDOOR air handling requirement.

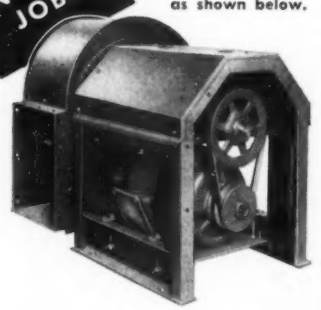
Use Ready Units and save the expense of building separate motor foundations. Use Ready Units and eliminate alignment problems. Use Ready Units for installations in record time and at lowest cost consistent with quality fan equipment.

Ready Units with or without Outdoor Covers shipped immediately. Specially constructed units for handling corrosive gases, etc., take a little longer.

WRITE FOR READY UNIT CATALOG 515 giving details, capacities and dimensions on the most modern "packaged" fan units available today — address, CLARAGE FAN COMPANY, Kalamazoo, Michigan.

INDOOR JOBS

Standard Ready Units (except three largest sizes) afford protection to fan bearings, motor and drive as shown below.

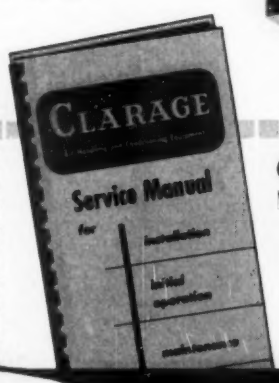


OUTDOOR JOBS

Cut below shows Ready Unit equipped with (easily removable) Outdoor Covers shielding all working parts from rain and snow.

LARGER SIZES

Cut at left shows standard Ready Unit as built in three largest sizes. These larger units, too, can be equipped with Outdoor Covers.



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. . . Quick and Easy to Install!

Grinnell Welding Fittings

Any qualified welder can make welds quickly and easily with Grinnell welding fittings. These fittings are made by a hydraulic forging process that assures uniform wall thickness at all points and true circularity throughout. Of seamless, one-piece construction, they can be cut at any angle to match up with standard weight, extra strong and heavier wall pipe in I.D. or O.D. sizes. Pressure-temperature ratings are equal to or greater than those of seamless steel pipe. Grinnell welding fittings are process stress-relieved.

Full data on the complete line of Grinnell seamless carbon steel welding fittings and forged steel flanges is contained in the Grinnell Welding Fittings catalog. Send for a copy.

GRINNELL
WHENEVER PIPING IS INVOLVED

RANGE OF TYPES AND SIZES

Description	Standard Weight	Extra Strong	Schedule 160	Double Extra Strong	Light Gauge	
					Nominal Pipe Size	Iron Pipe Size
ELBOWS 90° Long Radius	½"-30"	½"-30"	1"-12"	¾"-8"	4"-24"	¾"-12"
90° Long Tangent	1½"-12"	1½"-12"	.....	.....	.....	.....
90° Reducing	2"x¾" to 6"x5"		.....	.....	.....	.....
90° Short Radius	1"-30"	1½"-30"	.....	.....	.....	.....
45° Long Radius	½"-30"	¾"-30"	1"-12"	¾"-8"	4"-24"	¾"-12"
RETURNS 180° Long Radius	½"-30"	½"-30"	1"-12"	2"-8"	4"-24"	¾"-12"
180° Short Radius	1"-30"	1½"-30"	.....	.....	.....	.....
180° Ex. Long Radius	1"-2½"	1"-2½"	.....	.....	.....	.....
TEES — Straight	½"-24"	½"-24"	½"-12"	½"-8"	.....	.....
Reducing Outlet	½"-24"	½"-24"	¾"-12"	¾"-8"	.....	.....
REDUCERS Concentric & Eccentric	¾"-24"	¾"-24"	¾"-12"	¾"-8"	.....	.....
CAPS	¾"-24"	¾"-24"	1"-12"	1"-8"	.....	.....
STUB ENDS — Lap Joint	½"-24"	½"-24"				
SADDLES	2"-24"					
LATERALS — Straight	1¼"-24"	1¼"-24"				
Reducing	1¼"-24"	1¼"-24"				
CROSSES — Straight	1¼"-24"	1¼"-24"				
Reducing	1¼"-24"	1¼"-24"				
BACKING RINGS	2"-24"	2"-24"				

Also available in certain sizes are: 90° long and short radius elbows, 45° long radius elbows and 180° long and short radius returns in Schedules 30, 40, 60 and 80.

Grinnell welding fittings and flanges conform to applicable ASA and ASTM Standards.

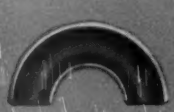
GRINNELL WELDING FITTINGS ARE QUALITY-CONTROLLED FOR DEPENDABILITY

TRUE CIRCULAR SECTION

True circular section at all points makes a Grinnell fitting easy to align and weld . . . there is no distortion or no flattening to affect flow adversely.

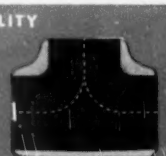
FULL EFFECTIVE RADIUS

The loss of pressure through Grinnell welding elbows is held down to an absolute minimum . . . because of the full and the effective sweep of the radius.



SMOOTH, CLEAN INSIDE SURFACE

Grinnell Fittings have uniformly smooth inner walls . . . no waves or ridges to cause turbulence or accelerate erosion or corrosion. No pockets to trap solids.



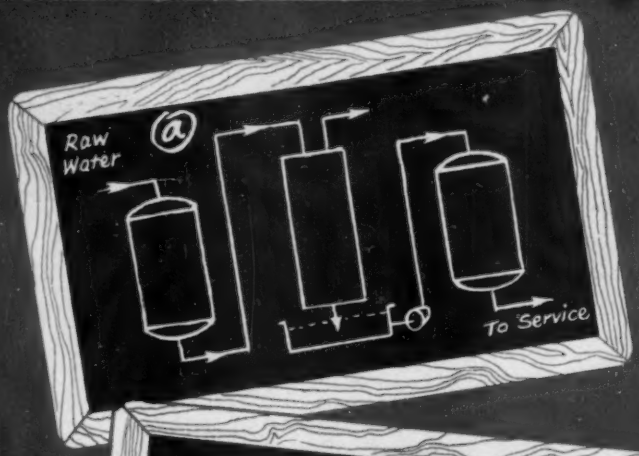
EASY, SWEEPING TURNS

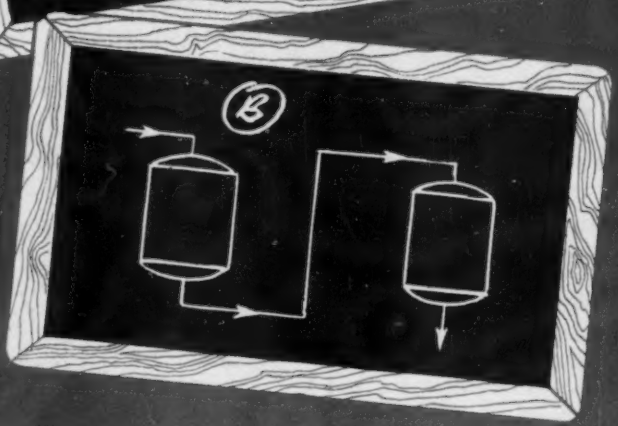
In Grinnell welding tees, corners where outlet joins the run are well-rounded and perfectly smooth to minimize resistance to flow and to prevent trapping.

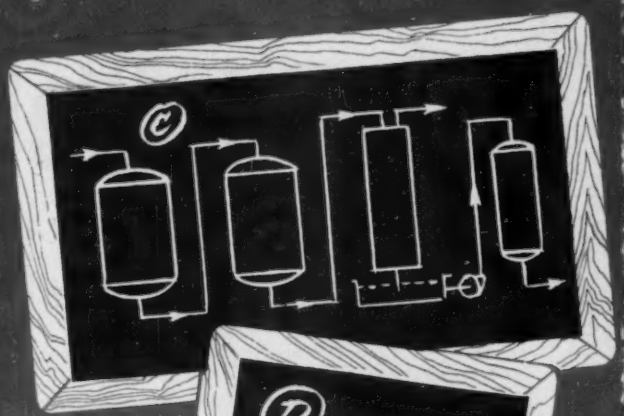
Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

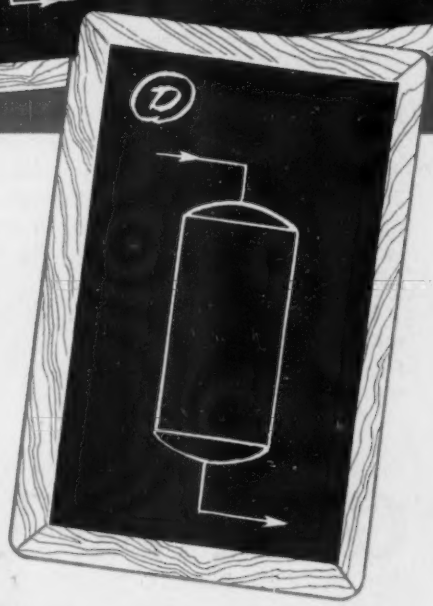
pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

The ABC's of Better Boiler Feedwater









● Permutit ion exchange processes remove dissolved mineral matter including silica. And produce feedwater equivalent to distilled water at only a small fraction of the cost of distillation.

For high pressure power plants that means it is now possible to avoid boiler scale and hard-to-remove silica deposits on turbine blades.

Demineralization is accomplished by the use of two ion exchange resins—Permutit Q and Permutit S. Permutit Q is a high capacity hydrogen cation exchange resin. Permutit S is a highly basic anion exchange resin.

Several arrangements of equipment are used depending on the individual requirements—composition of the raw water, volumes to be treated, boiler pressures and operating conditions. Permutit will cooperate with you in selecting the hookup best suited for your boiler plant. Write today for full information.

A **TWO STEP WITH DEGASIFIER:** In large demineralizing plants, a degasifier is usually included as an inexpensive means for removing carbon dioxide.

B **TWO STEP WITHOUT DEGASIFIER:** No repumping required. Used where total quantities are not very great or with waters of low bicarbonate content.

C **THREE STEP WITH DEGASIFIER:** Extremely economical and effective arrangement for waters containing relatively high amounts of sulfates and chlorides.

D **MIXED BED:** An extremely compact arrangement. Both cation and anion exchangers are in the same unit. Used alone or as a final step.

The equipment described is also furnished in multiunit arrangements to treat whatever quantities of water are required and to meet all operating conditions.

PERMUTIT

The sole manufacturer of both ion exchangers and water conditioning equipment of all types.
THE PERMUTIT COMPANY, Dept. P-2,
330 West 42nd Street, New York 36, N. Y.

Permutit Company of Canada, Ltd.
6975 Jeanne Mance Street, Montreal.

ION EXCHANGE AND WATER CONDITIONING HEADQUARTERS